Ed Beaudoin
BERA

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

REMEDIAL INVESTIGATION REPORT VOLUME NO. 1

Bedford Village Wells Hunting Ridge Mall Site Westchester County, New York

prepared for the
New York State Department of Environmental Conservation

by
DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
SYOSSET, NEW YORK

JUNE 1989

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June 23, 1989

Mr. Edward Beaudoin, Jr., Project Manager
Division of Hazardous Waste Remediation
Bureau of Eastern Remedial Action
New York State Department of Environmental
Conservation
50 Wolf Road
Albany, New York 12233

Re: Bedford Village Wells RI/FS
Alternative Water Supply Study
D&B No. 842

Dear Mr. Beaudoin:

As requested, please find enclosed seven copies of the final draft Remedial Investigation Report for the above referenced site. The enclosure incorporates essentially all of the Department's comments on the preliminary draft report which were contained in a mark-up of the document and in a memorandum dated April 26, 1989.

The only notable comment which was not addressed in the final draft RI Report was the inclusion of the results of the Fred C. Hart report prepared for the Ponds Development. After review of this document we could not ascertain the location of many of the sampling points, nor the QA/QC procedures utilized and the results thereof. Without this information, we could not utilize the results of this investigation as part of the Hunting Ridge Mall RI report.

However, since the Hart report raises possible concern regarding the finding of contamination on the Ponds Development property, a confirmatory investigation should be undertaken.

As a final note, we anticipate forwarding the final draft of the Shopping Arcade Site to your office in about two weeks. If you have any questions, or require additional information, please call me.

Very truly yours,

Thomas F. Maher

TFM:ft
Enclosure
cc: Mr. Robert Foltin

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
BEDFORD VILLAGE WELLS
HUNTING RIDGE MALL SITE
WESTCHESTER COUNTY, NEW YORK

REMEDIAL INVESTIGATION REPORT
VOLUME NO. 1

Prepared For

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

By

DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
SYOSSET, NEW YORK

JUNE 1989

REMEDIAL INVESTIGATION REPORT APPROVAL FORM

BEDFORD VILLAGE WELLS
HUNTING RIDGE MALL SITE
WESTCHESTER COUNTY, NEW YORK

Approved by:

Project Manager ______________________ Date: 6/23/89
Dvirka and Bartilucci Consulting Engineers

Assistant Project Manager ______________________ Date: 6/23/89
Dvirka and Bartilucci Consulting Engineers

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S.0 SUMMARY

In 1978, because of suspected releases of chemical contamination from dry cleaners, the Westchester County Department of Health (WCDH) conducted a county wide survey of these potential sources of chemical releases. In 1983, the survey included the dry cleaner located in the Hunting Ridge Mall in Bedford Village, New York, and comprised an inspection and sampling of the dry cleaner's waste solvents and the Mall's on-site sanitary system and stormwater drainage system. The sample results indicated significant contamination of both systems by the dry cleaning solvent, tetrachloroethene, and some of its breakdown compounds (trichloroethene and 1,2-dichloroethene).

Based on these findings, in 1983, the Mall owner was required by WCDH to pump out the sanitary system and remove contaminated sediment from the drainage system and nearby stream to which it discharges. In addition, also in 1983, the property owner was required to sample soil in the vicinity of the sanitary system leaching field and install three monitoring wells on the Mall property to determine if ground water was impacted. The initial results of the sampling program indicated that soils contiguous and beneath the leaching system were contaminated; however, in 1985, resampling showed no contamination.

Sampling of the ground water detected contamination in excess of New York State standards for both ambient water quality and drinking water. During this investigation period (1983 to 1985), WCDH sampled private water supplies in the area of the Hunting Ridge Mall, and also found private wells downgradient of the Mall contaminated by tetrachloroethene and its degradation products. Sampling by the United States Environmental Protection Agency (USEPA) in 1986, confirmed contamination of the private drinking water supplies.

As a result of these findings, the New York State Department of Environmental Conservation (NYSDEC) as part of the New York State Superfund Program, placed the Hunting Ridge Mall Site on the State Superfund List and retained the services of Dvirka and Bartilucci Consulting Engineers to conduct a Remedial Investigation and Feasibility Study (RI/FS). The goals of the RI/FS were to determine/verify the nature, source and extent of contamination in the vicinity of the Mall, assess impacts on human health and the environment, and depending on the results of the investigation, identify, evaluate and select, a long-term cost-effective remedial action to mitigate contamination.

A separate RI/FS was also conducted simultaneously at the Shopping Arcade Site located about one mile northeast of the Hunting Ridge Mall. The results of the Shopping Arcade study, which also involved contamination by a suspected dry cleaner and was similar in scope to the investigation of the Mall, is contained in a separate report.

The Remedial Investigation of the Hunting Ridge Mall Site, which is the subject of this report, was conducted from June 1987 to April 1989, and comprised a multi-phase, multi-matrix sampling program including ground water, surface water, stormwater drainage system sediment surface water sediment, septic tank sludge and supernatant samples. Phase IA, conducted in August 1987, and Phase IB, conducted in May and June 1988, evaluated potential sources, surficial contamination and possible routes of migration. Information from these phases were used to design the Phase II investigation. Phase IIA, conducted from August 1987 to December 1989, and IIB, conducted from April 1988 to September 1988, characterized the hydrogeology and ground water quality underlying the study area as well as assessing the potential for further migration.

Phases IA and IB comprised the sampling of the Hunting Ridge Mall sanitary system (one sample), a hardware store sanitary system (two samples), the stormwater drainage system in the Mall and along Route 22 (two samples), the stream to which the drainage system discharges (seven samples), ponds downgradient of the stream (five samples) and the Mianus River to which the stream/pond system discharges (four samples). Phase IA comprised about an equal number of analyses for Hazardous Substance List (HSL) compounds and volatile organic chemicals (VOCs), whereas Phase IB comprised analyses primarily for VOCs.

Phase IIA and IIB involved the installation and sampling of 20 monitoring wells in and contiguous to the Hunting Ridge Mall Site at 12 locations, as well as the sampling of the three existing wells installed previously by the owner of the Mall. Soil samples were obtained during the construction of the deepest borehole at each well cluster location, and a total of 36 ground water samples were collected from the monitoring wells. Similar to the Phase I sampling program, the Phase IIA program comprised about a equal number of HSL and VOC analyses, while IIB comprised only VOC analyses.

As a result of concerns expressed by local residents regarding the quality of drinking water from private wells, a third phase not included in the original scope of work was undertaken (Water Supply Sampling Program) which involved the sampling of 46 private (residential and commercial) wells and one community water supply system in the study area. This sampling program, which involved analysis primarily for VOCs, nitrates, and a limited number of analysis for HSL compounds, was conducted in October and November 1988.

The findings of the Remedial Investigation sampling program, the public health/environmental risk assessment and recommendations for potential remedial action to be considered in the Feasibility Study, are as follows.

Source/Sanitary System Contamination

The analysis of wastewater in the sanitary system that serves the Hunting Ridge Mall (no sludge was found in the septic tank) showed only minor concentrations of solvents typically used in dry cleaning and their breakdown products. This, together with the most recent results obtained from analysis of soils contiguous to and beneath the Mall's effluent leaching system, indicate that there is little continuing contamination resulting from the dry cleaning operation, and no (or little) residual contamination in the soil resulting from prior discharges. However, a significant concentration of toluene (340 ug/l), as well as other contaminants such as phenol (44 ug/l) and methoxyethane (80 ug/l), was detected in the Mall septic tank supernatant.

Sampling of the hardware store sanitary system supernatant detected relatively low levels of 4-methyphenol (58 ug/l) and a few acids. However, substantial concentrations of 1,4-dichlorobenzene (1,060 ug/kg), phenol, 4-nonyl (11,000 ug/kg), copper (480 mg/kg), lead (130 mg/kg) and zinc (2,300 mg/kg) were found in the septic tank sludge. The levels of copper, lead and zinc exceeded the New Jersey Department of Environmental Protection (NJDEP) standards and guidance values for soils used in determing the need for remediation.

Stormwater Drainage System Contamination

Sampling of sediment in the catch basins along the stormwater drainage system servicing the Hunting Ridge Mall and Route 22 showed little contamination. This indicates that the prior drainage system sediment removal was effective and no (or little) continuing source/surface contamination exists at the Mall site. The only catch basin which showed slightly elevated concentrations of organic chemicals (tetrachloroethene [39 ug/kg], trichloroethene [17 ug/kg], trans-1,2-dichloroethene [51 ug/kg], 1,1,1-trichloroethane [6 ug/kg] and toluene [4 ug/kg]) was adjacent to the Mall building. These contaminant levels are not considered significant in relation to standards and guidance values established by NJDEP used in determining the need for remediation. However, levels of silver (7.1 mg/kg) and selenium (7.4 mg/kg) were found in the catch basin sediment that exceeded the NJDEP soil guidelines.

Stream and Pond Contamination

Results of sediment samples obtained from the ephemeral stream along Lake Avenue to which the Mall's stormwater drainage system discharges show little residual contamination. The prior action (sediment was removed as part of previous remediation) appears to have been effective in reducing contamination in the stream bed, which earlier appeared to have been a secondary source of ground water contamination.

Turtle Pond at the point to which the stream discharges, however, shows significant sediment contamination (total VOCs of 905 ug/kg, including tetrachloroethene [600 ug/kg], trichloroethene [240 ug/kg] and trans-1,2-dichloroethene [31 ug/kg]). This level of contamination approaches the New Jersey Department of Environmental Protection's soil cleanup guidance value of 1,000 ppb total VOC's based, and is subject to potential release to the Mianus River (which is a source of drinking water to a downstream community) during storm events. Ground water samples obtained from a monitoring well (MW-10) located adjacent to Turtle Pond did not show the detection of tetrachloroethene and its breakdown compounds. Therefore, the contaminated sediment found in Turtle Pond does not appear to be effecting ground water quality. Samples from the two other ponds downstream of Turtle Pond indicated little or no contamination.

Mianus River Contamination

Except for 2-butanone (methyl ethyl ketone), which was found in both upstream and downstream samples of water and sediment, the Mianus River showed little contamination. This included a sample point located at the discharge of the above discussed stream/pond system to the river.

Subsurface Soil Contamination

In the unsaturated zone, except for one sample at the MW-6 well cluster location in the Pond Development Property at a depth of 10 feet, no other subsurface soils were found to be significantly contaminated. The isolated sample at MW-6 (tetrachloroethene of 1,560 ug/kg) appears to be an anomaly with no apparent source and may perhaps be a laboratory reporting error. (This was a screening analysis and not performed by a certified laboratory.)

Ground Water Contamination

Based on the results of sampling monitoring wells and water supply wells in the study area, an area of ground water contaminated primarily by the dry cleaning chemical, tetrachloroethene and its breakdown compounds has been identified. This area of contamination, which is approximately 300 feet in width, extends from the Hunting Ridge Mall property to about 1,200 feet downgradient of the Mall property. Based on the nature of the chemicals detected and the location of the dry cleaning establishment, this primary plume of ground water contamination most likely resulted from prior discharges to the Mall's sanitary system and/or the stormwater drainage system. A secondary plume, which is located in the vicinity of Lake and Vinton Avenues, appears to have been created by prior contamination of the stream located along Lake Avenue that previously contained sediments contaminated by organic chemicals as described above under stream and pond contamination. These two plumes appear to commingle at the end of Vinton Avenue. Based upon historic information and data obtained during the Remedial Investigation, it appears that contamination will persist in the subsurface environment of the study area above standards and guidance values established for ambient ground water quality.

Water Supply Contamination

As described above, sampling of community and private wells in the study area revealed significant contamination of water supply based upon exceedance of ambient ground water standards and guidelines and drinking water standards, both within the boundary of the Mall property and along Lake and Vinton Avenues. Although there is some contamination by benzene, toluene and xylene, most likely caused by an earlier reported gasoline leak/spill at a gas station in the study area, most of the contaminants appear to be related to dry cleaning solvents and its degradation products. Based on trends in the levels of ground water contamination, it appears that after a decline in the early 1980's, concentrations of contaminants appear to have stabilized at mostly low levels, but in a large portion of the study area still above standards established by New York State for both ground water and drinking water. Because it appears that this is basically residual contamination after the cessation of source releases, it is expected that the contaminant levels will persist for some time above standards established for drinking water, and thereby will continue to impair water supply until they are eventually displaced from the subsurface environment underlying the study area.

Health Risk Assessment

Carcinogenic and non-carcinogenic risks were computed for human receptors using domestic wells which utilized ground water as a source for water supply, residences which utilize surface water from the Mianus Reservoir as a source for water supply, and human receptors consuming fish from the Mianus River.

Results of non-carcinogenic risks indicate that these risks, as measured by the hazard index value, are well below the acceptable value of 1 recommended by the United States Environmental Protection Agency (USEPA). The highest value of hazard index encountered is 0.07, which is two orders of magnitude lower than the acceptable value.

Results of carcinogenic risks posed to human receptors using the Mianus Reservoir as a source of potable water, and human receptors consuming contaminated fish (trout) from the Mianus River (assuming worst-case scenarios of contamination) are well within the USEPA recommended acceptable range of 10^{-4} to 10^{-7}.

Calculated carcinogenic risk posed to human receptors using domestic wells which are supplied by ground water were examined using two approaches.

The first approach utilized ground water data from monitoring wells screened at different zones of the water bearing strata in the study area. Results of this approach indicate that the carcinogenic risk posed by the overburden water bearing strata is well within the USEPA recommended acceptable range of 10^{-4} to 10^{-7}.

For the overburden/bedrock and bedrock water bearing strata, the carcinogenic risks lie in the range of 9.06×10^{-5} to 2.72×10^{-4}. These values of the computed risk are slightly higher than the highest USEPA recommended value of 10^{-4} (carcinogenic risk values posed by the bedrock water bearing strata are slightly higher than those posed by the overburden/bedrock).

Individual carcinogenic risk of specific compounds indicate that contaminants of concern which lead to the high carcinogenic risk values for the overburden/bedrock and bedrock ground water are those associated with the dry cleaning solvent tetrachloroethene, including its breakdown compounds trichloroethene, 1,2-dichloroethene and vinyl chloride.

Since the source of this contamination appears to have ceased, a possible remaining source of ground water contamination may be the contaminated sediments in Turtle Pond. Further investigations would be necessary in order to delineate the extent of sediment contamination and evaluate its potential impact on ground water. However, monitoring wells installed adjacent to Turtle Pond did not show contamination by the contaminants found in the sediments thereby indicating that the contaminants are bound with the sediments and are not impacting ground water quality.

The second approach towards evaluating the risks posed by ground water use involved computation of carcinogenic risks based on data available at receptor points prior to water treatment. Results of this analysis indicate that the lowest risk is posed for human receptors at points located hydraulically upgradient and laterally away from the suspected source. However, since some of the receptor points in the study area are within close proximity to the delineated plumes of contamination, the highest range of the computed risk (2.27×10^{-4}) is slightly higher than the USEPA acceptable range of 10^{-4} to 10^{-7}. The contaminants of concern which give rise to the higher values of the computed risk are those associated with the dry cleaning solvent tetrachloroethene and its breakdown compounds.

Results of remaining scenarios within the contaminated plumes also give carcinogenic risk values which are higher than the acceptable USEPA range of 10^{-4} to 10^{-7}. Again, the data indicates that the contaminants of concern giving rise to the high risks are those associated with the dry cleaning solvent tetrachloroethene and its breakdown compounds.

It must be noted that the dermal route of exposure yields risks which are well within the acceptable USEPA recommended range. Ingestion and inhalation are the routes of concern.

Remedial action to address the areas of contamination, routes of migration and potential receptors identified in this report will be addressed in detail in the next phase of this investigation which is referred to as the Feasibility Study. The Feasibility Study will identify potential remedial alternatives, evaluate these alternatives based on effectiveness, implementability and cost, and select a remedial action plan which will include a conceptual design, preparation of a cost estimate, and schedule for implementation.

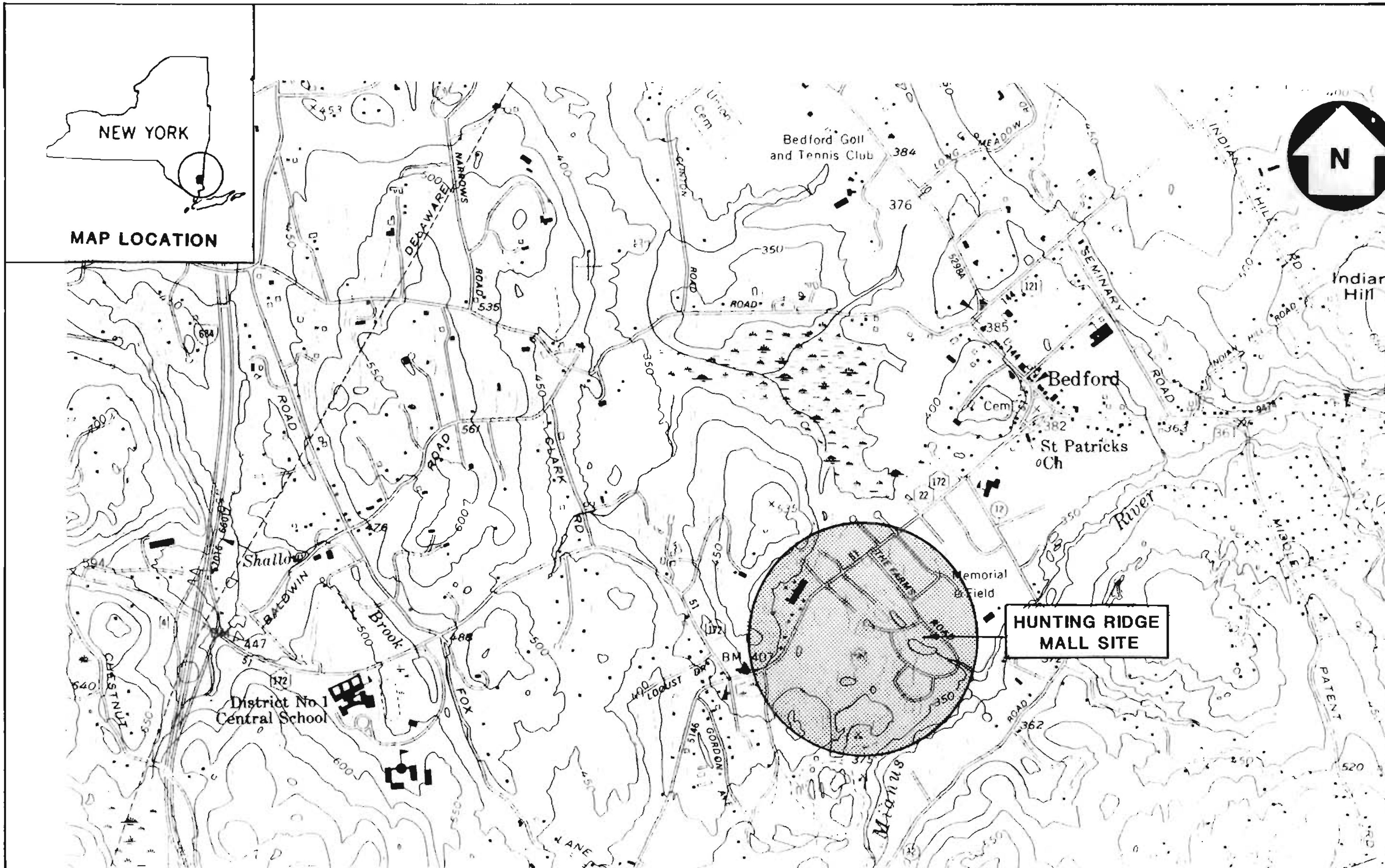
Section 1

1.0 INTRODUCTION

As part of the State of New York's efforts to clean-up inactive hazardous waste sites, the New York State Department of Environmental Conservation (NYSDEC) entered into a contract with the firm of Dvirka and Bartilucci Consulting Engineers of Syosset, New York to undertake a Remedial Investigation and Feasibility Study (RI/FS) for the Bedford Village Wells-Hunting Ridge Mall Site located in Westchester County, New York (see Figure No. 1-1). The RI/FS for this site is being conducted with funds allocated under the New York State Superfund Program. The purpose of the overall RI/FS process is to determine the nature and extent of contamination at the site, the sources of contamination, the risk to public health and the environment, and to perform a Feasibility Study (FS) which will identify and evaluate mitigation alternatives, and recommend a cost-effective, environmentally sound and long-term remedial action. The Remedial Investigation (RI) portion of the project, which comprises primarily the field program and health risk assessment, began in August 1987 and was completed in April 1989. This report presents the results of the Remedial Investigation. After finalization of this report, the Feasibility Study will be undertaken. The Feasibility Study will take approximately five months to complete, after which, a second report describing the recommended remedial action(s) will be prepared.

1.1 Site Background

In 1978, the Westchester County Department of Health (WCDH) became aware of ground water contamination and potential drinking water problems in areas where present and past dry cleaning establishments have been located. An investigative program was established which collected numerous well samples throughout the County. The results of the initial investigation revealed contaminated wells in Katonah, Armonk, and Bedford Village (Shopping Arcade). Contaminated wells located at and contiguous to the Hunting Ridge Mall Site, also located in Bedford Village, were discovered by WCDH in 1983. The sources of contamination at these sites were suspected to be dry cleaning establishments which disposed of wastes into sanitary and stormwater drainage systems. Both Bedford Village sites involve private water supply well contamination.



MAP SOURCE: NYS DOT
MOUNT KISCO QUADRANGLE

SCALE: 1"=2000'

Dvirka and Bartilucci
CONSULTING ENGINEERS

LOCATION OF HUNTING RIDGE MALL STUDY AREA

FIGURE NO.
1-1

1.1.1 General Description

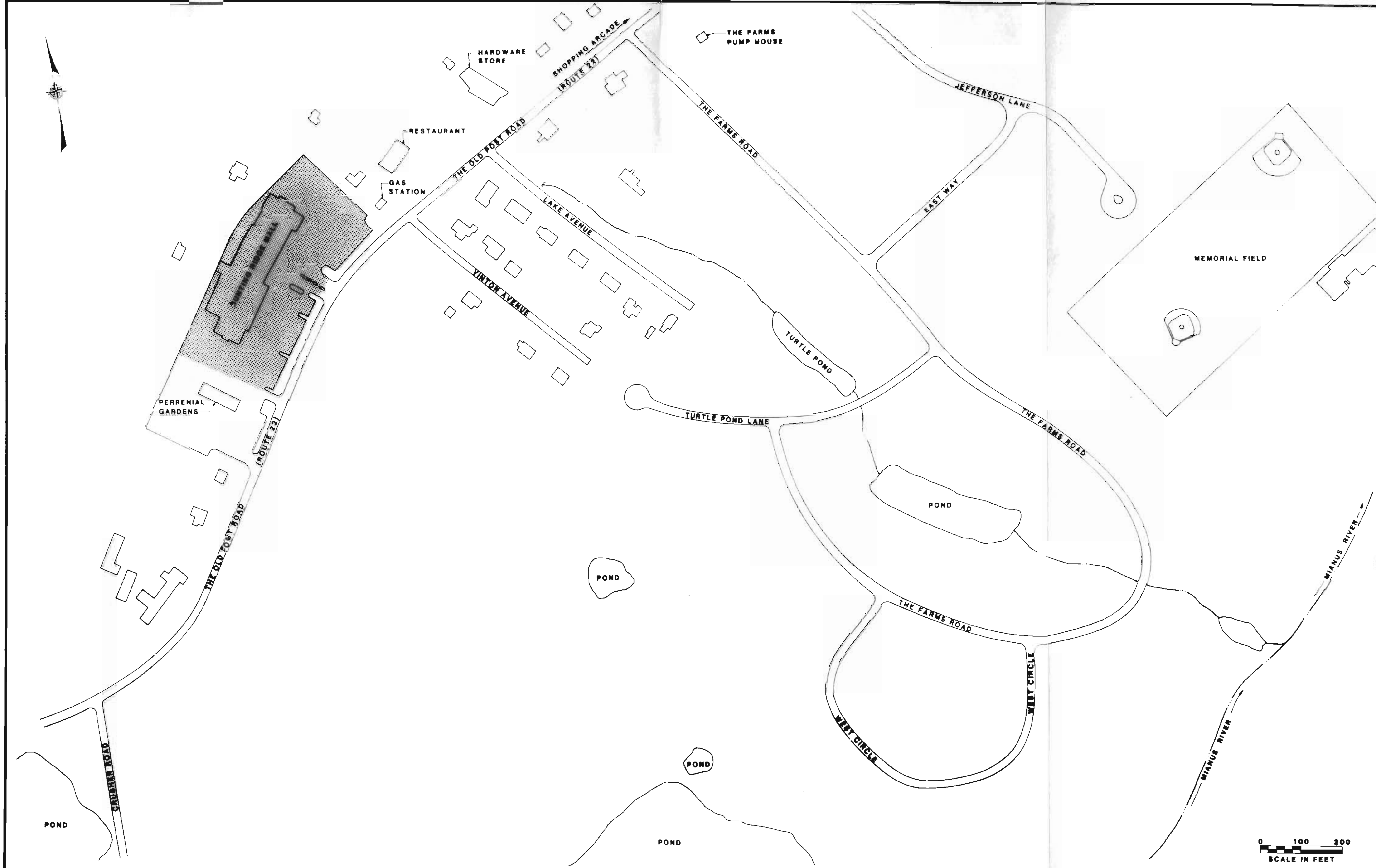
The Hunting Ridge Mall, located on Old Post Road (Route 22) in the Town of Bedford (see Figure No. 1–2) is approximately one mile southwest of the Bedford Village business district. (Shopping Arcade Site.) The 1983 sampling program conducted by WCDH revealed that 14 of the 29 wells tested were contaminated with volatile organic chemicals (VOCs) including tetrachloroethene, trichloroethene and cis–1,2–dichloroethene. Due to the nature of the chemicals found, the source of contamination was thought to be from the dry cleaning establishment operating in the Mall. Based on earlier existing data, the extent of contamination appeared to be limited to the Hunting Ridge Mall property and areas along and adjacent to Lake and Vinton Avenues which are located east of the Mall. Although the early sampling results did not show a clear trend of concentration, generally the levels of ground water contamination were declining or stable at that time.

1.1.2 Site History and Previous Investigations

1979 The Westchester County Commissioner of Health releases an "Information Bulletin" to certain dry cleaning establishments in Westchester County outlining proper storage and disposal methods for cleaning wastes.

1983 Wehran Engineering, under contract to NYSDEC, submits the Bedford Village Wells Phase 1 Investigation Report. This report focuses only on the Shopping Arcade Site.

The Westchester County Department of Health completes Interim Report–Investigation of the Occurrence of Volatile Organic Chemicals in Well Water Supplies in the Vicinity of Lake Avenue and Vinton Avenue in the Town of Bedford, New York. The sampling program included the testing of 29 private wells, 3 municipal wells (Bedford Farms Water Company, Inc.), a stormwater drainage system, Turtle Pond, the Hunting Ridge Mall sanitary system, and the dry cleaner's waste solvents. Of the 29 wells sampled, 14 contained volatile organic chemicals. High levels of these chemicals were also found in the Mall sanitary system and in the adjacent stormwater drainage system. As a result of these findings, WCDH ordered the Mall owner to clean out all catch basins and drainage pipes.



NO.	DATE	REVISION	INT.

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PROJECT ENGINEER:	DRAWN BY:
DESIGNED BY:	CHECKED BY:

Dvirka and Bartilucci
CONSULTING ENGINEERS
Syosset, New York

BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL SITE
AND STUDY AREA

PROJECT NO. 842
DATE:
SCALE: AS NOTED
FIGURE NO. 1-2

Four drums of dry cleaning solvent wastes were removed from the rear of the Mall and sediments were removed from the Mall's stormwater drainage system as well as along Route 22 and Lake Avenue.

1984 Wehran Engineering completes the Bedford Village Wells Phase II Investigation Report for the New York State Department of Environmental Conservation. The Phase II Report, which focuses primarily on the Shopping Arcade Site, does contain sampling results for the Hunting Ridge Mall Site. Although the Mall is located just 4,000 feet southwest of the Shopping Arcade, researchers feel that the contamination at the two sites is not related.

1985 C.A. Rich Consultants completes February 1985–Monitoring Well Report for the Hunting Ridge Mall Bedford, NY for the Hunting Ridge Mall owner. The three monitoring wells installed on the Mall property confirm the presence of tetrachloroethene, trichloroethene and cis–1,2–dichloroethene at maximum concentrations of 141 micro–grams per liter (ug/l), 24 ug/l and 30 ug/l, respectively. Two of these wells exceeded the New York State Department of Health drinking water guidelines at that time of 100 ug/l for total VOCs.

C.A. Rich Consultants, under contract to the Mall owner, completes Soils Sampling and Analyses Hunting Ridge Mall Bedford, New York, September 30, 1985. Eleven sampling locations were chosen around the sanitary system area behind the Mall. Neither the Westchester County Department of Health Laboratory nor Nytest Laboratories (retained by C.A. Rich Consultants) found concentrations of tetrachloroethene, trichloroethene or cis–1,2–dichloroethene.

Leggette, Brashaers & Graham, Inc., consulting ground water geologists for the Town of Bedford, completes Ground Water Assessment Town of Bedford, New York. The report provided a comprehensive description of Bedford's hydrogeology.

1986 Tap water sampling programs undertaken by the Westchester County Department of Health and the United States Environmental Protection Agency (USEPA) reaffirm the presence of VOCs in private well water supplies on Lake and Vinton Avenues.

NYSDEC requests five engineering firms to submit proposals for the Bedford Village Wells Remedial Investigation/Feasibility Study project.

1987 NYSDEC, in conjunction with the New York State Department of Health (NYSDOH), Town of Bedford and the Westchester County Department of Health, select Dvirka and Bartilucci (D&B) Consulting Engineers of Syosset, New York to undertake the project.

The State approves the Bedford Village Wells–Hunting Ridge Mall Site and Shopping Arcade Site RI/FS contract between D&B and the Department of Environmental Conservation.

1.2 Nature and Extent of the Problem

Prior to undertaking the RI/FS, organic chemicals previously identified in the contaminated wells were tetrachloroethene, trichloroethene, cis–1,2–dichloroethene, vinyl chloride, chloroform, 1,1,1–trichloroethane and 1,1–dichloroethane. High levels of the first four compounds, as well as some high levels of BTX (benzene, toluene and xylene), were also found in the stormwater drainage and sanitary systems in the study area. Tetrachloroethene is commonly used in dry cleaning operations, and trichloroethene, cis–1,2–dichloroethene and vinyl chloride are its breakdown products. The compounds 1,1,1–trichloroethane and 1,1–dichloroethane, each found separately in only single well samples, could be the result of septic tank cleaners used in private sanitary systems in the study area. Chloroform, also found in only one sample, was most likely a laboratory contaminant and not indicative of ground water contamination in the area. BTX most probably results from disposal or leaks and spills of gasoline.

Based on early data, the extent of ground water contamination appeared to be limited to the Hunting Ridge Mall and the area along and adjacent to Lake and Vinton Avenues. Other private well samples obtained from the immediately surrounding area showed little or non-detectable levels of contamination. As mentioned previously, although it appeared that the levels of ground water contamination had been generally decreasing, analysis of the data obtained from 1983 to 1986 did not indicate a clear trend of declining contamination for all wells. Based on this information, it was thought that sources (including contaminated soils) could be continuing to release organic chemicals to the surrounding environment.

1.3 Discussion of Waste Types and Component Characteristics

An understanding of the pathway of migration and degradation, and the resulting breakdown products of organic compounds in ground water and aquifer systems is essential to a site investigation. Characterizing the degradation pathway of organic compounds is important in determining to what extent a contaminant may have affected the system and can aid in locating the source of a particular chemical compound. This knowledge is pertinent from an environmental impact and a health and safety standpoint, as the breakdown/daughter chemical products of certain organic contaminants may be more toxic than the initial parent compound (tetrachloroethene).

As previously discussed, it was known through past investigations that the dry cleaner in the Mall disposed of waste/wastewater containing tetrachloroethene (perchloroethene [PCE]) into the Mall sanitary and stormwater drainage systems. Tetrachloroethene is a common straight chain chlorinated aliphatic hydrocarbon. Two of the natural pathways by which residual tetrachloroethene is removed from soils and ground water are: 1) chemical degradation and 2) dissolution and advection via ground water flow.

Studies conducted on tetrachloroethene and its breakdown compounds have concluded that the major pathway by which PCE is lost from surface water (Dilling et al., 1975) is by evaporation. Reactivity studies found that sunlight had the greatest effect on the rate of PCE disappearance from surface water (Dilling et al., 1975).

Studies conducted on tetrachloroethene and its daughter products in the subsurface have concluded that PCE is resistant to biodegradation in aerobic environments except under specific conditions such as the presence of natural gas. However, several studies (Parsons et al., 1984) have documented a sequential reductive dechlorinated pathway of PCE in anaerobic subsurface environments. In the absence of light and oxygen, micro-organisms utilize the energy released from the oxidation and reduction reactions for cell growth and maintenance.

Tetrachloroethene exhibits the following anaerobic sequential degradation:

Tetrachloroethene (PCE)

Trichloroethene (TCE)

Cis-dichloroethene (DCE)　　Trans-dichlorothene (DCE)

Vinyl chloride
(chloroethene)

In general, the rates of transformation decrease as chlorine is removed (Vogel, McCarty, 1985). Studies (Fathepure, Nenguard Boyd, 1987) have identified the specific cultures of anaerobic bacteria that dechlorinate tetrachloroethene. However, to date no one has identified the specific bacteria responsible for the reductive dechlorination of chlorinated ethenes, although it is clearly a biological reaction.

Chlorinated solvents are widely used in this country for cleaning and degreasing fibers, fabrics and metal surfaces. United States production records show about 750,000,000 pounds of tetrachloroethene and 325,000,000 pounds of trichloroethene are produced annually. A review of the annual production quantities of these chlorinated solvents makes it understandable how small amounts of these compounds could enter the environment as contaminants.

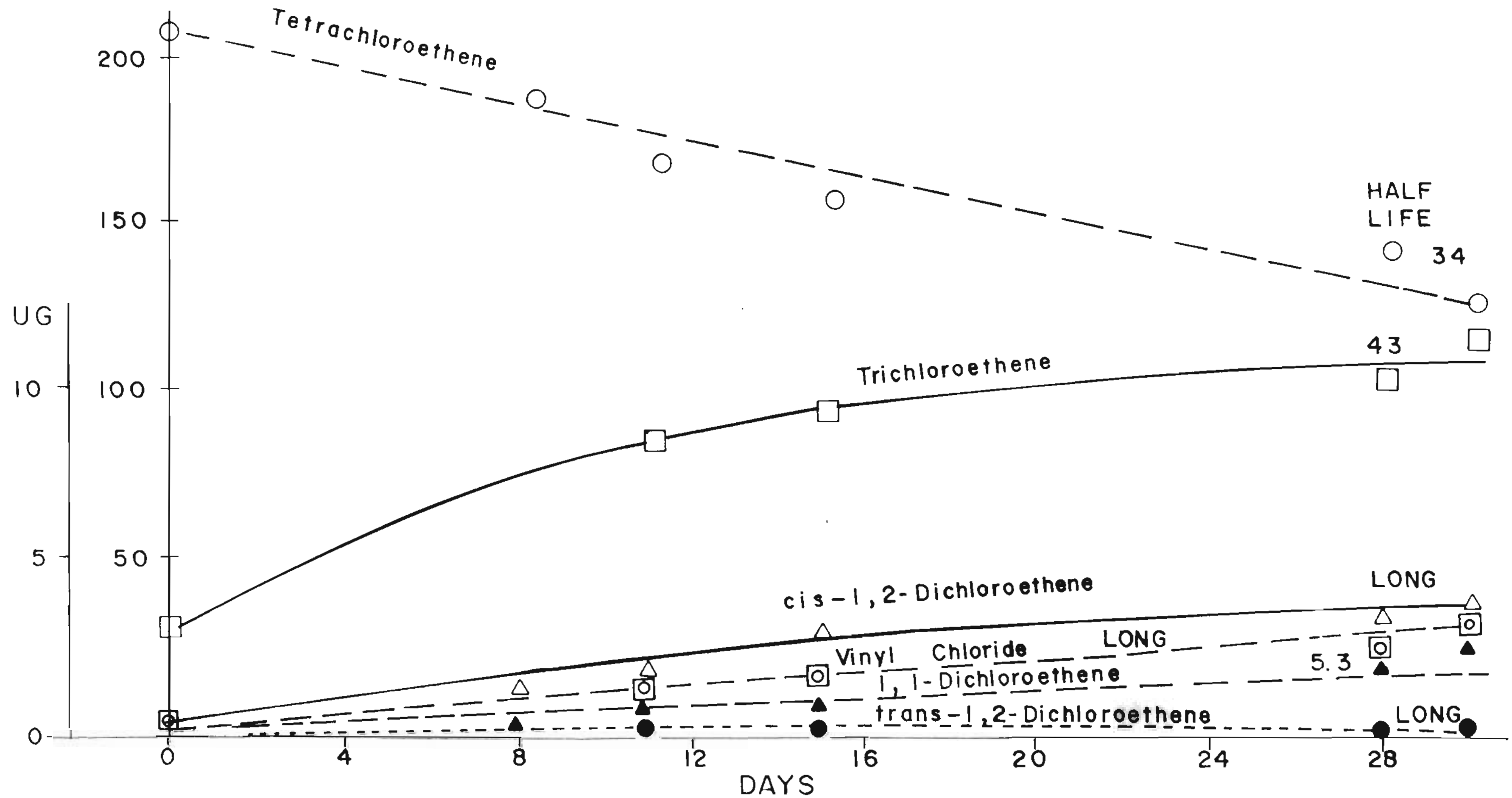
It has been suggested that in part or in whole, a contributing factor for the levels of breakdown products detected in ground water may be contained in the parent compound as impurities, or the repeated use of PCE in dry cleaning (many weeks at constant reflux, followed by repeated redistillation) might result in formation of daughter compounds by thermal–hydrolytic breakdown. However, laboratory analyses of new and used PCE have shown that vinyl chloride, trans– and cis–1,2–dichloroethene or 1,1–dichloroethene were not detected in the new or used PCE (Wood et al., 1981).

Studies performed (Jensen and Rosenberg, 1975) on the effect of heat on PCE degradation also support the results above. PCE levels in boiled, deionized water in a closed system did not exhibit any significant decrease after eight days.

Wood (1981) noted that at sites where only tetrachloroethene and trichloroethene were used and spilled, high levels of 1,1–dichloroethene were detected in ground water. In addition, high levels of trichloroethene were found associated with tetrachloroethene spills, and vinyl chloride was found only in ground water that initially contained high concentrations of trichloroethene and/or tetrachloroethene. Based on these results, it appears that the breakdown of tetrachloroethene in ground water is the result of anaerobic biotransformation as described above.

Laboratory experiments were performed on tetrachloroethene and biodegradation curves were assembled (see Figure No. 1–3). The half–life of tetrachloroethene was estimated to be approximately 34 days. During the 30 day test period, the breakdown/daughter compounds formed (trichloroethene, cis–1,2–dichloroethene, etc.) are also shown. The concentrations of the breakdown compounds are represented by the Y axis. Referring to this figure, it is possible to predict, based upon the half–life, which compound will be present in water long after the parent compounds have completely biodegraded.

Cis– and trans–1,2–dichloroethene and vinyl chloride all have a relatively long half–life and would be expected to persist in the ground water environment. It should be noted that the calculated half–life degradation curves and the formation of daughter products from tetrachloroethene are based upon ideal laboratory conditions. While the biological transformations of chlorinated aliphatic hydrocarbons have been reported on the basis of numerous laboratory studies, only three reported field observations are known to exist. Unfortunately, even these reported field cases are only briefly described, giving no details (Silka and Wallen).



Source: Wood et al.,1981

DECAY OF TETRACHLOROETHENE AND INCREASE OF BREAKDOWN COMPOUNDS

Dvirka and Bartilucci CONSULTING ENGINEERS

FIGURE NO. 1-3

In the natural environment, site specific conditions will most likely be less than ideal. Bacteria populations, temperature, nutrient resources and seasonal fluctuations all can and will effect the transformation of chlorinated aliphatics. A field study conducted at a site in the northeast contaminated with chlorinated solvents found no evidence for biotransformation (Smith, 1988). This observation led to the conclusion that there was a lack of a sufficient carbon/nutrient source to sustain an adequate biological community. The retardation rate depends on the fraction of organic carbon in the aquifer. Potential carbon/nutrient sources that can affect bacteria populations may be commercial and residential sanitary systems such as exist in the Hunting Ridge Mall Study Area. The subsurface lithology can also affect the availability of the carbon/nutrient source. Fairly coarse grained high permeability sediments will allow percolation of nutrients into the water table. This occurence explains why the breakdown products of tetrachloroethene have been readily found in ground water samples in and contiguous/downgradient of the Mall site.

1.4 Corrective Measures Undertaken To Date

Interim measures have been undertaken to mitigate future contamination and to reduce adverse effects of the present contamination. Granular activated carbon (GAC) treatment units have been installed in a number of residences along Lake and Vinton Avenues. These filters, where maintained, have been effective in reducing VOC levels to non-detectable limits.

As described earlier, the dry cleaning establishment in the Mall retained a licensed waste hauler to properly dispose of all cleaning solvents. The stormwater drainage system and receiving stream bed along Lake Avenue, previously having high VOC levels, were dredged of contaminated sediments in 1983. Also, in 1985, the Mall owner had independently conducted two studies which sampled the Hunting Ridge Mall ground water and sanitary leaching field soil. The original sanitary system at the Mall has been removed and a new system constructed.

1.5 Overview of the Remedial Investigation

The Remedial Investigation was designed as a sequential progression of multiple phased sampling and data analysis programs. The objective of this strategy was to apply data generated from previous phases of work to the design of future phases. In this way, a cost-effective, targeted program was implemented which generated meaningful specific data.

The following subsections present a brief summation of the various phases of field work conducted during the Remedial Investigation. In addition, the individual programs incorporated into the particular phases of work, including health and safety, quality assurance and control, and data validation are also reviewed.

1.5.1 Description of the Phased Approach

The first component of the Remedial Investigation field effort was the Phase I sampling program. The Phase I sampling program was divided into two sub–phases (Phase IA and Phase IB) which were targeted to sample commercial sanitary systems, stormwater drainage systems, the stream/pond system tributary to the Mianus River, and the river itself. The purpose of these phases was to determine/confirm the location of the sources and extent of contamination, and to assist in refining the location of any additional surficial sampling and/or ground water monitoring well locations needed in subsequent phases. The Phase IA and Phase IB programs were similar in scope except that greater emphasis was placed on analysis of volatile organic compounds (VOCs) in Phase IB rather than the Hazardous Substances List (HSL) compounds in the Phase IA program. The Phase IB sampling program was based on the results of the Phase IA program as well as the Phase IIA program discussed below.

The next phase of the Remedial Investigation field effort was the Phase II sampling program. The Phase II program was also broken into two sub–phases (Phase IIA and Phase IIB) which were designed to investigate the subsurface source(s), characterize site hydrogeology, and define migration of contamination within the study area. The Phase IIA well locations and depths resulted from information gathered from the 1985 ground water investigation performed by the Mall owner and the Phase IA results.

The design of the Phase IIB sampling program reflected the incorporation of the data generated from the Phase IA, Phase IB, and Phase IIA programs. The objective of the Phase IIB was to provide confirmatory data for defining the nature, extent and source(s) of ground water contamination. Similar to the Phase IB sampling program, emphasis was placed on analysis of VOCs (entirely) in Phase IIB rather than the HSL Compounds in IIA (and IA).

1.5.2 Surface Geophysical Studies

A comprehensive geophysical seismic refraction survey was conducted in the Hunting Ridge Mall Study Area as part of the Phase IA program. The purpose of this survey was to obtain data regarding the depth to ground water and depth to bedrock throughout the study area.

The data obtained from this survey was evaluated prior to the commencement of the Phase IIA well drilling program to aid in the placement of wells, and to assist in projecting the depth to which overburden/bedrock interface and bedrock wells would need to be completed. The seismic data and resulting map also provided a regional conceptionalization of trends in the slope of bedrock and the thickness of the stratified drift deposits in the river valley. The details of this seismic refraction survey are discussed in Section 4.1.1 of this report.

1.5.3 Source and Surficial Sampling and Analysis

The review of existing data generated by previous studies conducted in the Hunting Ridge Mall Study Area determined that it was necessary to design a surficial sampling program as part of the Remedial Investigation. The objective of the surficial sampling program was to document the type and concentrations of contamination in the septic, stormwater and stream/pond drainage systems at and contiguous to the site, and the downstream receiving water (the Mianus River).

The first phase source/surficial sampling and analysis program was targeted to the following matrices:

- Septic tank sludge
- Septic tank supernatant
- Stormwater drainage system sediment
- Stream and pond surface water
- Stream and pond sediment
- Mianus River water
- Mianus River sediment

The companion component of the first phase (Phase IA) of the program was the Phase IB sampling program which targeted the same matrices. The Phase IB program was designed to further define sources of contamination, fill data gaps and confirm data generated as part of the initial Phase IA surficial sampling program.

1.5.4 Subsurface Sampling and Analysis

The second phase sampling and analysis program of the Remedial Investigation was comprised of a subsurface investigation designed to characterize the hydrogeologic regime underlying the study area. In addition, the data generated during the program was utilized to identify sources of ground water contamination and to define the lateral and vertical extent of contamination in the ground water.

As described in Section 1.5.1, the Phase II sampling program consisted of two sub-phases. The initial Phase IIA sampling program involved the installation of ten monitoring wells at six locations within the study area. All but one of the locations consisted of a well cluster. The well clusters, as opposed to a single well, consisted of either two or three wells in the same general location, constructed in individual boreholes, and screened at different depths.

The Phase IIB sampling program involved the installation of ten additional wells at six locations. The objective of the Phase IIB sampling program was to confirm the definition of the nature, extent and sources of ground water contamination.

In addition to the 20 monitoring wells installed at the Hunting Ridge Mall Study Area during the Remedial Investigation, there existed three monitoring wells at the site from a previous study. In total, 12 locations and 23 monitoring wells in the Hunting Ridge Mall Study Area were sampled for ground water quality data.

1.5.5 Organic Vapor Screening of Soil Samples

As part of the construction of the deepest monitoring well at each location/cluster, soil samples were obtained at five foot intervals using a split spoon sampler. These samples were utilized predominantly in characterizing the unconsolidated deposits of the study area. In addition, the soil samples were also screened in the field for the presence of total volatile organic compounds.

The results of this screening of volatile organic compounds were used in interpreting and differentiating zones of contaminant migration in the unconsolidated stratified drift deposits underlying the study area. Samples which recorded significant volatile organic values were collected and sent to a field laboratory for chemical analysis/screening.

1.5.6 Soil Gas Survey

The New York State Department of Environmental Conservation (NYSDEC) retained the services of the United States Environmental Protection Agency (USEPA) to conduct a soil gas survey in the Hunting Ridge Mall Study Area. Under ideal conditions, VOCs present in the ground water may also be identified in the overlying vadose zone through the use of soil gas investigations.

Soil gas sampling and analysis was utilized as a reconnaissance tool in an attempt to delineate the plume of ground water contamination underlying the study area. Based on the sampling results, a map was prepared by USEPA which illustrated the concentration gradients of soil gas contaminants. Once the data from the soil gas survey was examined, it was necessary to confirm the predictions of the location and concentrations of contaminants identified during the survey. The soil gas survey map assisted in determining the placement of the Phase IIB soil borings and the ground water monitoring well network. The results of the soil gas survey are discussed in Section 4.1.4.

1.5.7 Borehole Logging Tests

Downhole borehole logging tests were performed at the two locations of the deepest bedrock monitoring wells (MW–4B and MW–6B) within the Hunting Ridge Mall Study Area. The downhole borehole logging tests conducted included caliper, resistivity, gamma–ray and specific potential logging.

The predominant rationale for performing the downhole logging at these two well locations within the study area was to obtain a better understanding of the degree of fracturing within the metamorphic bedrock (Fordham Gneiss) and assess its influence, if possible, on the pathway by which contaminants are migrating through the bedrock zone.

1.5.8 Permeability

Permeability is the capacity of a media for transmitting a fluid. It is a measure of the relative ease of fluid flow under a pressure gradient and used to estimate flow of ground water.

For the purpose of this investigation, permeabilities were estimated by applying the Hazen Equation to grain size information. The grain size data was derived from soil samples that were obtained at the screen depths of several representative monitoring well locations within the study area. The Hazen Equation is $K = Ad_{10}^2$, where the parameter K represents permeability. The parameter d_{10} represents effective grain size and is taken directly from the grain size gradation curve as determined by sieve analysis, and is the grain size diameter at which 10% by weight of the soil particles are fines and 90% are coarser. For K in cm/s and d_{10} in mm, the coefficient A is equal to 1.0.

1.5.9 Ground Water Level Measurements

Ground water level measurements were obtained from the completed wells in December 1987, May 1988, September 1988 and November 1988. These measurements were essential for:

- Calculating the direction and magnitude of lateral and vertical hydraulic gradient within the unconsolidated and bedrock units in the Hunting Ridge Mall Study Area.

- Determination of seasonal fluctuation in water levels.

- Determination of hydraulic interconnection between the shallow and deep water table zones.

1.5.10 Surveying and Mapping

Upon completion of the well installation program, all monitoring wells were surveyed vertically to an accuracy of 0.01 feet in relation to mean sea level. The monitoring wells were also surveyed horizontally. The vertical elevations are essential in establishing water levels with respect to a common datum (mean sea level) to develop ground water elevation contour maps and flow direction, as well as profiling geologic cross–sections.

The horizontal data was incorporated into the construction of a site base map onto which all data obtained during the Remedial Investigation could be plotted and referenced.

1.5.11 Aerial Photography and Topographic Mapping

In order to provide an illustrative base map for the study area, an aerial photograph was obtained at a scale of 1 inch to 100 feet. This photograph taken in April, 1984. In addition, to provide information on direction of surface drainage as well as ground water flow, topographic contours were plotted at five foot elevation intervals referenced to mean sea level. This aerial topographic map is contained in Appendix A.

1.5.12 Health and Safety Program

The Health and Safety Plan, as defined in detail in the work plan for the Hunting Ridge Mall Study Area, was implemented during the field investigation.

The principle chemical hazards of concern in the study area consisted of volatile organic chemicals. Routine monitoring was conducted at all drilling and sampling sites to evaluate the potential exposure hazards so that the proper health and safety precautions could be exercised. All monitoring and surveillance equipment (Century Organic Vapor Analyzer [OVA], Photovac Tip and portable combustible gas/oxygen detector) was operated, maintained and calibrated each working day in accordance with the manufacturer's manual and Dvirka and Bartilucci Consulting Engineers' Quality Assurance (QA) procedures. Organic vapor monitoring was undertaken prior to and following sampling at the site as well as throughout drilling operations. At no time during the remedial field investigation did the total VOC vapors exceed background (less than 1 ppm) in the breathing zone.

Level D protection was maintained throughout all phases of the remedial field investigation except during Phase I when septic tank samples were collected. As an extra precautionary measure, Level C protection (full-face respiratory protection, protective coveralls [tyveks], nitrile gloves, etc.) was utilized when the field team collected samples from the sanitary system at the Hunting Ridge Mall and hardware store. Although the ambient VOC concentrations in air did not exceed background levels during this sampling, Level C safety procedures were exercised as a precaution to possible vapor emissions.

1.5.13 Quality Assurance/Quality Control Program

The Quality Assurance/Quality Control (QA/QC) Plan, as defined in detail in the work plan for the Hunting Ridge Mall Study Area, was implemented during the remedial field investigation.

All environmental samples collected as part of the field investigation were collected in accordance with the sampling procedures outlined in the QA/QC Plan.

Field management procedures, including the preparation of Sample Information Record Forms, Location Sketches, Chain-of-Custody Forms, Daily Quality Control Reports and maintenance of a daily field log book, were undertaken during all sampling and drilling activities.

QA/QC checks, including the utilization of trip blanks, field blanks, matrix spikes, matrix spike duplicates and method blanks, were performed as described in the QA/QC plan and in accordance with the NYSDEC 1986 Contract Laboratory Protocol (CLP).

1.5.14 Data Validation

Analytical data resulting from the sampling program was reviewed to determine compliance with the 1986 Contract Laboratory Protocol (CLP) QA/QC requirements developed by the New York State Department of Environmental Conservation (NYSDEC). The QA/QC parameters reviewed for organics were: holding time, instrument tune, initial and continuing calibration, method blanks, surrogate spikes, matrix spike/matrix spike duplicates, field blanks and trip blanks. For inorganics, the QA/QC parameters reviewed were: initial and continuing calibration blanks, laboratory control samples, ICP interference, spike sample analyses and duplicate samples.

The data validation process is used to ensure that the laboratory followed the requirements set forth by the NYSDEC and extraneous chemical contamination was not introduced into the environmental samples. Samples that did not meet the QA/QC criteria, were resampled and reanalyzed.

A data validation report was prepared for each sampling phase of this project with a detailed discussion of the validation results. The results of data validation are discussed in Sections 3.0 and 4.0, and provided in detail in the Data Validation Reports prepared as part of this investigation and contained in separate documents.

1.6 Overview of Report

As an introduction to the report and as presented above, Section 1.0 provides a general description into the site background that led up to conducting this Remedial Investigation. Also included in this section, is an overview of the nature and extent of the chemical contamination as documented by previous investigations, and a discussion of waste types and characteristics as they pertain to the contaminants of concern in the study area (tetrachloroethene) and its breakdown compounds. In addition, an outline of the phased approach undertaken during this Remedial Investigation is provided which includes a summary of the individual programs/tasks which made up the scope of work. Other sections which make up this report include the following:

Section 2.0 describes the regional and site physical features of the Hunting Ridge Mall Study Area that can either be impacted by or can influence the migration of contaminants.

Section 3.0 provides the rationale for and investigative methods used in the Phase I (source and surficial) sampling program. Included in this section are the analytical sample results as reported by a NYSDEC certified laboratory.

Section 4.0 discusses the methodologies incorporated into the Phase II subsurface investigation. Analytical data is also provided from the soil and ground water samples obtained for this phase. In addition, this section presents a discussion of the regional and site specific geology and topography, as well as the surface and subsurface hydrology in the study area.

Section 5.0 provides a description and results of an extensive drinking water supply sampling program that was conducted as part of the Remedial Investigation.

Section 6.0 contains an overall discussion of the contamination encountered in the Hunting Ridge Mall Study Area. A presentation is provided with respect to source and surficial contamination as well as subsurface and water supply contamination that was encountered in comparison to environmental standards and guidelines.

Section 7.0 provides an assessment of the public health and environmental concerns related to the contaminants found in the study area. Critical contaminants are identified along with potential migration pathways, routes of exposure and receptors.

Section 2

2.0 SITE FEATURES

2.1 Demography

In a ranking of the 14 towns of Westchester County, Bedford ranks the seventh largest in terms of population (approximately 15,000). Between 1970 and 1980, the Town of Bedford's population decreased by 1.1 percent. From 1980–1985, however, the population of the Town is estimated to have increased by 4.7 percent. Table No. 2–1 indicates population changes between 1970 and 1985 for the Town of Bedford and for the North Westchester County towns. Projections to the year 2000, calculated by Westchester County Department of Planning (April 1985), are also shown.

The composition of the male and female population in Westchester County has shifted between 1970 and 1980. The female population became the prevalent group after the 18 years of age group and posed a modest gain over males in the 30 to 59 year age group. The greatest was gain in age group 22 to 29 years, with a 16.7 percent increase from 1970 to 1980. This age group is the forerunner in both household formation and entry into the labor force. The median age in Westchester County is 34.5 years of age, which is a higher median age than the New York Standard Metropolitan Statistical Area (SMSA), New York State and the region as a whole. Table No. 2–2 summarizes information from the 1980 census and indicates total population by age group for Westchester County, the Town of Bedford and all North County towns.

2.2 Land Use

The Town of Bedford is located in northeastern Westchester County. Bedford is bordered on the north by the Town of Somers and Lewisboro, on the east by the Town of Pound Ridge, on the south by the Town of North Castle and on the west by the Town of New Castle and the Town/Village of Mount Kisco. There are three unincorporated Hamlets in the Town of Bedford, these being Katonah, Bedford Hills and Bedford Village. The Town boundary is roughly square in shape and covers approximately 40 square miles or 25,600 acres.

The Town of Bedford is semi–rural in character making it an attractive residential community. The area immediately surrounding the Hunting Ridge Mall has zoning for, and

Table No. 2-1

POPULATION CHANGE 1970 – 1985 AND
PROJECTED POPULATION TO 2000

Area	1970	1980	Estimated 1985	% Change 1970–1985	Projected 1990	Projected 2000
Westchester	894,104	866,599	879,708	1.6	872,700	868,900
Bedford	15,309	15,137	15,855	3.5	16,000	16,200
North County Towns	215,727	226,549	241,337	11.9	244,700	248,400

Source: Westchester County Department of Planning

Table No. 2–2

TOTAL POPULATION BY AGE GROUPS AND PERCENT OF TOTALS – 1980

Area	0–21	22–64	65 and Over
Westchester	271,938 31.4%	480,502 55.4%	114,159 13.2%
Bedford	5,174 33.4%	8,996 58.2%	1,302 8.4%
North County Towns	69,514 34.0%	114,291 56.0%	20,358 10.0%

Source: Westchester County Department of Planning is occupied residential, with lot sizes of one-quarter and one-half acre (mostly), ranging to one and two acre occupancies. Surrounding the study area, the character of development changes to mostly four acre zoning (excluding the Village Green Area). Land use is mostly rural residential.

The Bedford Town Development Plan (adopted September 12, 1972) has made it an important objective to maintain its present rural historical character as it directs future development. Table No. 2-3 shows that the majority of vacant land with potential for development is privately owned in Bedford.

2.3 Natural Resources

The natural resources contained in and adjacent to the Hunting Ridge Mall Study Area consist of a river, floodplains, wetlands, ponds, wooded tracts and ground water.

Approximately one-half mile to the southeast of the Hunting Ridge Mall and bordering the downgradient portion of the study area is the Mianus River, its floodplain and associated wetlands. Within the study area, the Mianus River is a "Class AA - Special" water body as designated by NYSDEC. Its use is classified for drinking water supply because it is utilized as a primary drinking water source for a downstream community (Stamford, Connecticut).

A tributary to the Mianus River located northeast of the Mall and adjacent to Lake Avenue is an ephemeral stream and a series of three ponds. These water bodies, including the interconnecting streams and Turtle Pond, which is the largest of the three ponds, are also classified as "AA-S" because they are tributary to the Mianus River.

Directly adjacent to the Mall property and to the southeast is the Ponds Development Property which occupies approximately 115 acres. This property is composed of forested land which includes many large ponds that are remnants of a former sand and gravel quarry operation.

The area's macro-environments surrounding the site (river, floodplain, wetlands, ponds and woodlands) support an abundance of wildlife that is typical of southern New York.

Table No. 2-3

TOWN OF BEDFORD
LAND USES - 1982

Use	Percent (%)
Residential	17.7
Commercial/Retail	0.8
Industrial/Manufacturing	0.3
Institutional/Public Facilities	1.4
Open Space	5.0
Undeveloped (privately owned)	74.8

Source: Westchester County Environmental Planning Atlas

The ground water underlying the site is an important natural resource to the residents in and around the study area. Ground water is the sole source water supply for the residents in the study area and is classified as "GA" by NYSDEC. The stratified glacial drift deposits that compose the Mianus River Valley sediments are very permeable, which makes the ground water very susceptible to contaminants spilled on the ground surface or discharged to subsurface disposal systems.

2.4 Climatology

The climate of southeastern New York State, in which the study area is located, is broadly representative of the humid continental weather which prevails in the northeastern United States. The character of the topography and the relative proximity to a large body of water (Long Island Sound) have a pronounced effect on the overall climate.

General Climatic Features – The average climate for a particular region is the condition that can be expected over a period of time. Each locality, however, is influenced by the physiography and local topography. In addition, lakes, hills, forest cover and exposure can also create relatively striking differences within an isolated area. The average climatic condition in the vicinity of Bedford is considered to be moderate. There are extreme variations in heat and cold, but generally, the uncomfortable periods are of short duration.

Temperature – Over a period of years, weather records show the following averages:

January – Mean maximum temperature 38°F
Mean minimum temperature 23°F

July – Mean maximum temperature 85°F
Mean minimum temperature 61°F

Generally, winter temperatures are modified by nearby Long Island Sound. The coldest temperatures in most winters will range from 0° to 10°F for a period of five to six days.

In the summer, Bedford may experience rather warm high humidity periods with the temperatures exceeding 90°F for a period of 18 to 25 days.

Precipitation – The Bedford region has a fairly uniform distribution of rain fall. During the average year about 48 inches of rain falls in the region. The 1980–1981 period was an exception and a severe drought imperiled the major surface water storage basins/reservoirs (supplies) of the area and also had an impact on the ground water resources in the region.

Snowfall – Snowfall is also influenced by the Bedford physiography, topography and its proximity to Long Island Sound. Snowfall in the Town averaged between 40 and 50 inches a year with January generally being the month of greatest snowfall. Storms of freezing rain may be expected to occur one or more times each year.

Winds – The prevailing wind is generally from the west. A southwest flow of wind is dominant during the summer months and a northwest component is characteristic of the colder half of the year.

Thunderstorms and Hurricanes – The summer rain–thunderstorms occur on an average of 30 days in any given year. In the late summer and early fall, hurricanes occasionally sweep the area and strong winds and heavy rainfall result. These storm systems generally move quickly through the area.

2.5 Topography

The extent of elevation within the Hunting Ridge Mall Study Area varies approximately 185 feet. Elevations range from 350 feet to 535 feet above mean sea level. The topography of the area reflects both the subsurface and surface geology of the Mianus River Valley. Directly upgradient and to the northwest of the Hunting Ridge Mall, a ridge line rises steeply from 380 feet to a peak of 535 feet above mean sea level. The Mall itself and adjacent Route 22 are situated within the Mianus River Valley. The area downgradient and to the southeast of the Mall is generally flat. The slope from the Mall to the Mianus River drops approximately 30 feet within a half mile distance. This flat area to the southeast contains many ponds from former sand and gravel quarry activities as well as ponds associated with the surface water drainage system to the Mianus River. The Mianus River is bordered by wetlands. The topographic map of the study area produced as part of the Remedial Investigation is provided in the map pocket as Exhibit 1 at the end of this document.

Section 3

3.0 SOURCE AND SURFICIAL INVESTIGATION

3.1 Description of the Phase IA Sampling Program

The goal of this first phase of the source and surficial sampling program was to collect and evaluate environmental data in order to make an initial determination regarding the location of the sources of contamination, to assess the transport of contaminants through the study area and to assist in making decisions on the specific sampling locations for subsequent phases of the Remedial Investigation. The following activities were undertaken during the Phase IA program.

- Pertinent, available literature and technical reports and data were reviewed.

- A limited number of private well depth measurements obtained from the Westchester County Department of Health (WCDH) were confirmed in discussions with local homeowners. This data was used in defining the Phase IIA program and expanded upon as part of the Water Supply Sampling Program, both of which are discussed later in this report.

- Aerial photographs of the site were obtained and topographic maps were prepared to provide the most recent information on land use patterns, potential sources of contamination, local topography and drainage patterns.

- Lastly, environmental sampling was undertaken at the following general locations:

    - Septic tank sludge (solids)
    - Septic tank supernatant (liquid)
    - Stormwater drainage system sediment
    - Surface water (pond)
    - Surface water sediment (pond)
    - Mianus River water
    - Mianus River sediment

3.1.1 Sample Collection Methods

As part of the Phase I program, specific types of sampling equipment were utilized to obtain the various types of sample matrices. In many instances samples were readily accessible (stream sediment samples, surface water samples, etc.) and only required a stainless steel scoop for collection. In other instances, accessibility was more complex (septic tank samples, pond sediment samples, etc.) and more sophisticated sampling equipment was incorporated.

The following briefly describes the types of sampling equipment incorporated in collecting the source/surficial samples as part of the Phase I Remedial Investigation.

3.1.1.1 Surface Water and Wastewater Sampling

Surface water samples were collected by using a stainless steel ladle. Stainless steel material was utilized due to its noncorrosive nature. The collection of the supernatant/wastewater samples from septic tanks was achieved by utilizing a grab subsurface sampler. The grab subsurface sampler is constructed of aluminum tubing making it light weight. A sample glass bottle was attached to the aluminum frame and lowered into the septic tank and a sample was obtained.

3.1.1.2 Sediment and Sludge Sampling

When a particular sample point was easily accessible, such as a stormwater catch basin or open culvert, sediments were collected by the use of a stainless steel ladle or trowel. Where access was more difficult, such as in the collection of a sludge sample from the septic tank, a grab subsurface sampler was used.

3.1.1.3 Sample Preservation and Handling

Once samples were obtained, containers provided by the analytical laboratory were removed from the sample coolers and filled with the sample matrix. Samples were transferred directly from the collection equipment into the laboratory containers. Preservation methods were utilized as required by the NYSDEC 1986 Contract Laboratory Protocol (CLP) and included pH control by chemical addition, refrigeration and protection from light.

Upon completion of daily sampling, Chain–of–Custody Forms were completed and the sample coolers were delivered to the laboratory within 48 hours as required by NYSDEC.

3.1.1.4 Decontamiantion Procedures

Sampling equipment used during the Phase I investigation was decontaminated according to NYSDEC approved procedures. This involved the following in the sequence described below:

- o Equipment was washed with laboratory detergent and rinsed with potable water, followed by distilled water.
- o Equipment was then washed with a 50/50 mix of acetone and hexane (reagent grade), and allowed to air dry.

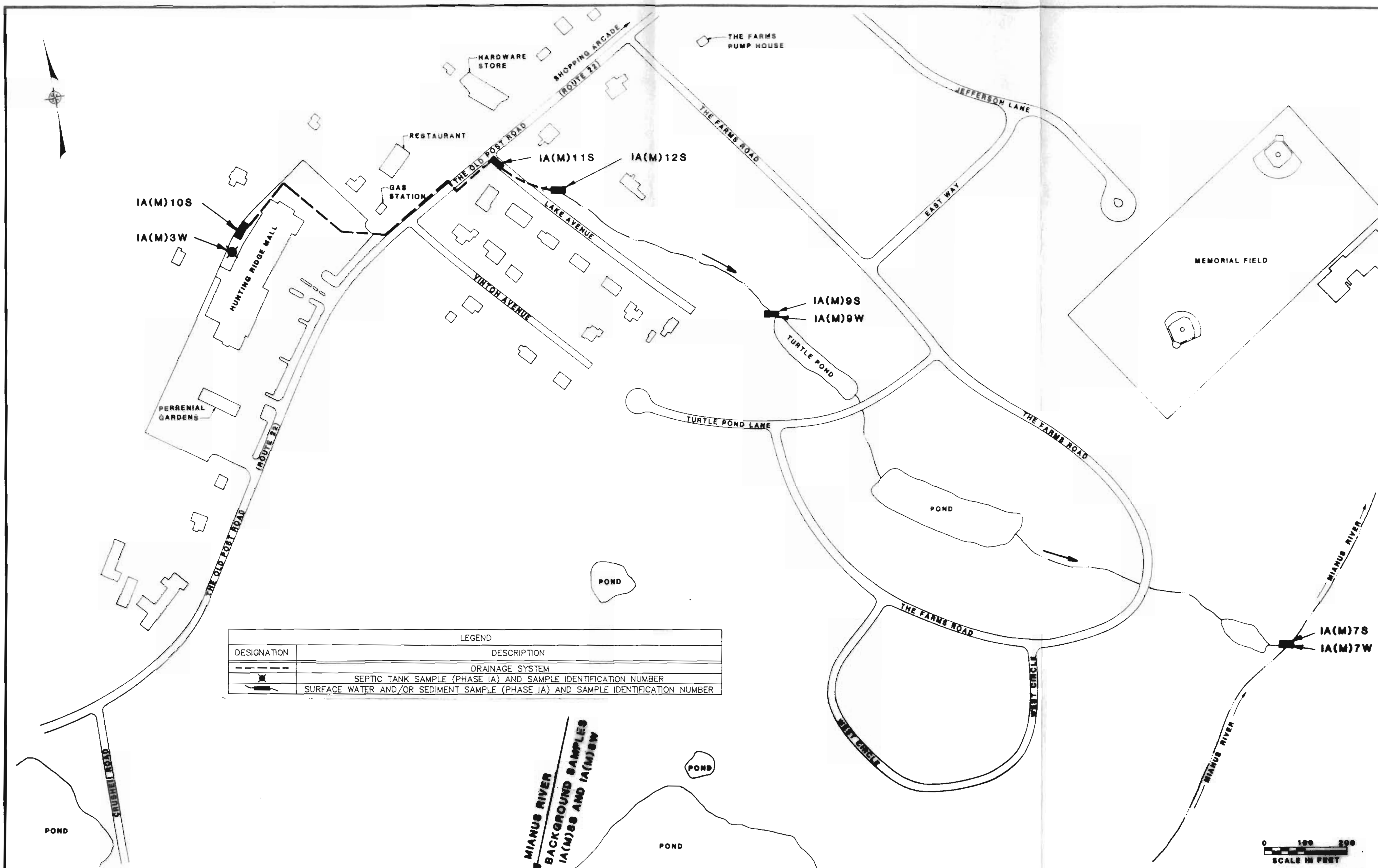
After equipment was dry, it was wrapped in aluminum foil (dull side against the equipment) until it was used for sample collection.

3.1.2 Selection of Sampling Locations and Sample Points

This section briefly reviews the rationale for selecting the various Phase IA sampling locations. The Phase IA sampling locations for the Hunting Ridge Mall Study Area are illustrated in Figure No. 3-1.

Septic Tank Sludge - Sludge in the existing septic tank at the Hunting Ridge Mall was thought to be a potential continuing source of contamination due to past disposal practices of the dry cleaner located in the Mall. Sampling the contents of the tank would confirm the effectiveness of the previous corrective actions which involved removal of contaminated material from the sanitary system undertaken by the Mall owner and elimination of waste discharges by the dry cleaning establishment. Provision was made in the work plan to collect two sludge samples from the septic tank.

Septic Tank Supernatant - Supernatant samples from the septic tank were obtained in an effort to determine if the sanitary system was continuing to contribute chemical contamination due to past disposal practices. Sampling the septic tanks would also confirm the effectiveness of previous remedial measures. Provision was made to obtain a total of up to four samples from the septic tank.



LEGEND	
DESIGNATION	DESCRIPTION
— — — —	DRAINAGE SYSTEM
	SEPTIC TANK SAMPLE (PHASE IA) AND SAMPLE IDENTIFICATION NUMBER
	SURFACE WATER AND/OR SEDIMENT SAMPLE (PHASE IA) AND SAMPLE IDENTIFICATION NUMBER

NO.	DATE	REVISION	INT

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.

PROJECT ENGINEER: DRAWN BY:
DESIGNED BY: CHECKED BY:

Dvirka and Bartilucci
CONSULTING ENGINEERS
Syosset, New York

BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
PHASE IA SAMPLING LOCATIONS

PROJECT NO. 842
DATE:
SCALE: AS NOTED
FIGURE NO. 3-1

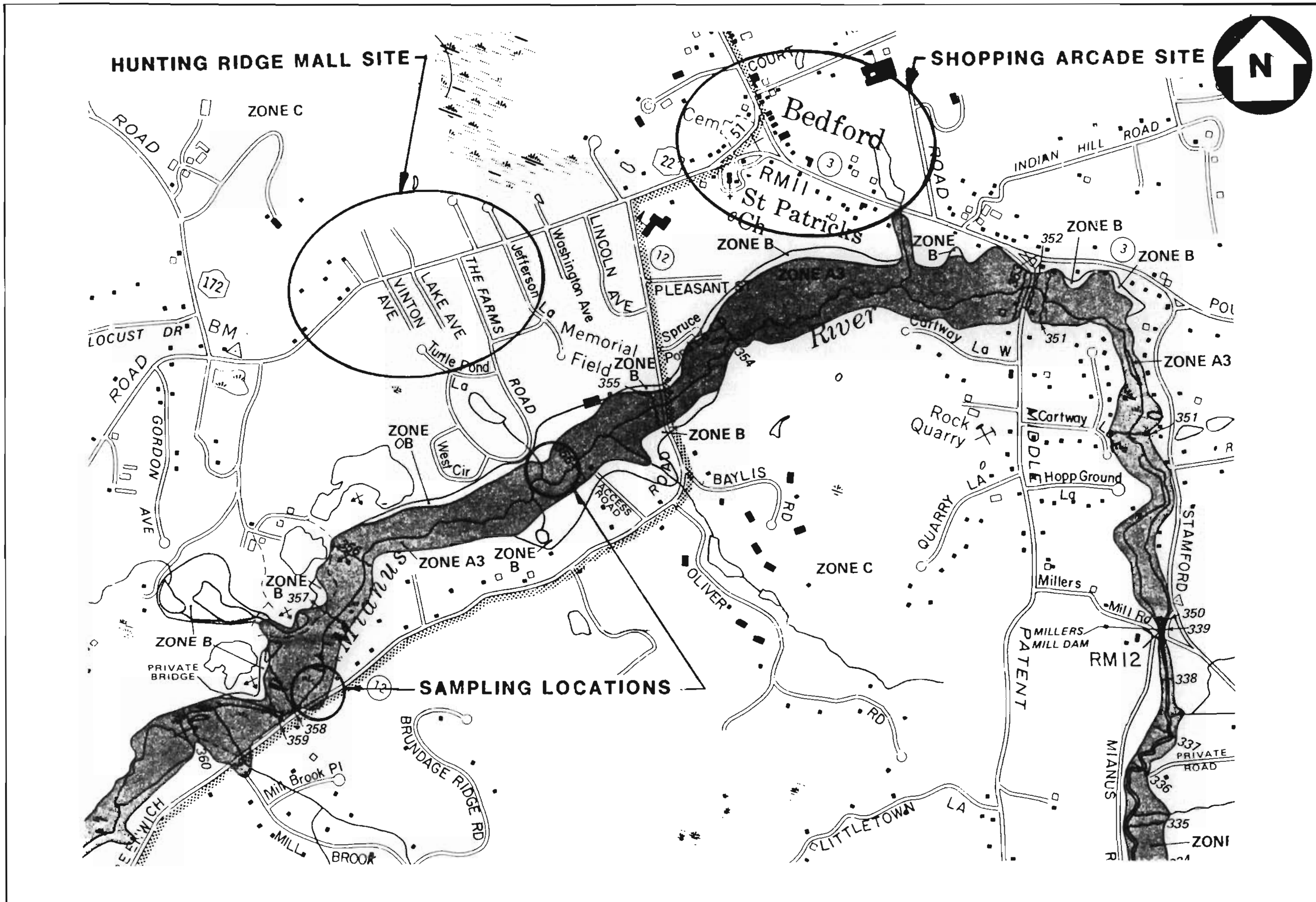
Stormwater Drainage System Sediment - Due to the discovery of contaminated sediments in the Hunting Ridge Mall stormwater drainage system in the past, the Mall owner dredged a portion of the system in 1983. Analyzing a limited number of sediment samples would assist in determining the effectiveness of past corrective action and in the evaluation of current sources of contamination. Three samples were obtained along the drainage system; two in the subsurface portion at catch basins, and one along the open culvert along the east side of Lake Avenue to which the drainage system discharges.

Surface Water (Pond) - Turtle Pond water samples were analyzed in the past and found to contain trace amounts of organic chemicals. Confirmation of increasing or decreasing concentrations would assist in determining the rate and extent of any continuing contamination to and in the pond. Provision was made to collect one sample at the inlet to Turtle Pond.

Surface Water Sediment (Pond) - A chemical evaluation of the sediments in Turtle Pond near the inlet where the Mall drainage system and receiving stream discharges had never been conducted and would provide information on contamination in the study area. Organic chemicals, such as those found in the study area, often demonstrate a high affinity to adsorb onto sediments in the environment. Provision was made to obtain one sample immediately below the sediment surface at the inlet to Turtle Pond.

River Water - Government officials and the public have raised concern over the extent of contamination in the study area and its possible impact on the Mianus River sediments and surface waters as this water body is used as a drinking water supply for a downstream community. Two samples were collected from a point immediately below the surface of the water, both upstream and downstream of its confluence with the Turtle Pond drainage system (see Figure No. 3-2). Including the samples collected as part of the Phase IA sampling program for the Shopping Arcade Site located nearby (about one mile northeast of the Mall Site), a total of four river water samples were obtained and analyzed.

River Sediment - Same rationale as above for River Water. Samples were collected immediately below the sediment surface at the same locations from which river water samples were collected.



Dvirka and Bartilucci CONSULTING ENGINEERS

HUNTING RIDGE MALL STUDY AREA
MIANUS RIVER SAMPLING LOCATIONS

FIGURE NO. 3-2

It should be noted that in the original scope of work provisions were made to obtain effluent samples from the leaching pools at Hunting Ridge Mall, as well as obtain split spoon soil samples adjacent to the leaching pools. However, when the Phase I sampling program commenced, the leaching pools had been removed and the Mall owner was in the process of installing a new septic field. Therefore, these planned samples were never obtained.

The provision for sampling the leaching pools was applied (with the concurrence of the NYSDEC) to sampling the septic tank supernatant. The split spoon soil sampling and analysis provision for three samples was postponed and, if needed, would be used in a later phase of the investigation. Table No. 3-1 summarizes the Phase IA sample locations, the number of samples collected and analyzed, and the rational for conducting the sampling.

3.1.3 Analytes of Concern

Based on review of the results of samples previously collected in the study area, primary and secondary analytes of concern were identified and defined for the Hunting Ridge Mall Site. The primary analytes of concern are those volatile organic chemicals resulting from dry cleaning operations comprising tetrachloroethene, trichloroethene, dichloroethene and vinyl chloride. The secondary analytes of concern include 1,1,1-trichloroethane and BTX compounds (benzene, toluene and xylene). For Phase IA samples taken, laboratory analysis was conducted to determine the presence of these analytes of concern. In addition, approximately 50% of the samples were analyzed for the complete array of Hazardous Substance List (HSL) compounds (see Appendix B).

3.1.4 Location of Background Sampling Points

The Phase IA sampling program was essentially designed to confirm data obtained in the past in an effort to better define the suspected source of contamination and recommend an appropriate remedial action, if required. During this and all subsequent phases of the program, samples were collected either upgradient (for ground water) from suspected sources of contamination or upstream/river (for surface water and sediment samples) as a control in the program. (Refer to Figure No. 3-2 for an illustration of the Mianus River background sampling location for Phase IA.)

Table No. 3–1

SUMMARY OF PHASE IA SAMPLING PROGRAM

Sampling Location	Number of Samples	Sample I.D. Number	Rationale
Septic Tank (Sludge)	0 (no sludge present)	—	Determine if sludge in the septic tank at the Mall is a source of continuing ground water contamination.
Septic Tank (Supernatant)	1	IA(M)3W	Determine if septage/effluent at the Mall is a continuing source of ground water contamination.
Stormwater Drainage System Sediment	3	IA(M)10S IA(M)11S IA(M)12S	Determine if the drainage system is contributing to ground water or surface water contamination in the study area.
Surface Water (Pond)	1	IA(M)9W	Determine if contamination exists in Turtle Pond surface water.
Surface Water Sediment (Pond)	1	IA(M)9S	Determine if contamination exists in the near surface sediment of Turtle Pond.
River Water	2	IA(M)7W IA(M)8W	Determine if contamination exists in Mianus River surface water.
River Sediment	2	IA(M)7S IA(M)8S	Determine if contamination exists in the Mianus River due to waste disposal in the study area.

3.2 Analytical Results of the Phase IA Sampling Program

The purpose of this section of the Remedial Investigation Report is to present the analytical results of samples which were collected during the baseline component of the first phase of the source and surficial sampling program. As mentioned above, detailed discussion concerning these results and implication in relation to causes and extent of contamination is presented in Section 6.0.

Figure No. 3-3 presents a map of the study area which identifies the locations throughout the Hunting Ridge Mall Study Area from which solid (sediment/sludge) and liquid (water/supernatant) matrix samples were collected along with the analytical results of each sample. For purposes of presenting sampling program results, each sampling point is identified by an identification number. For example, a sampling point labelled "IA(M)14W" would indicate the following. The "IA" portion of the identification number indicates that the sample was collected during the Phase IA portion of the sampling program. The "(M)" of the sample identification number designates that the sample was collected from within the Hunting Ridge Mall Study Area. The next portion of the sample identification is a number such as "1", "2", "3"... through "25." This identifies the specific sampling location in the study area. The last element of the sample identification number is either a "W" or an "S." This indicates whether the sample collected was a water (wastewater/surface water) or solid (sludge/sediment) matrix, respectively. The following example summarizes the nomenclature of the sample identification number:

denotes Phase IA Sampling Program

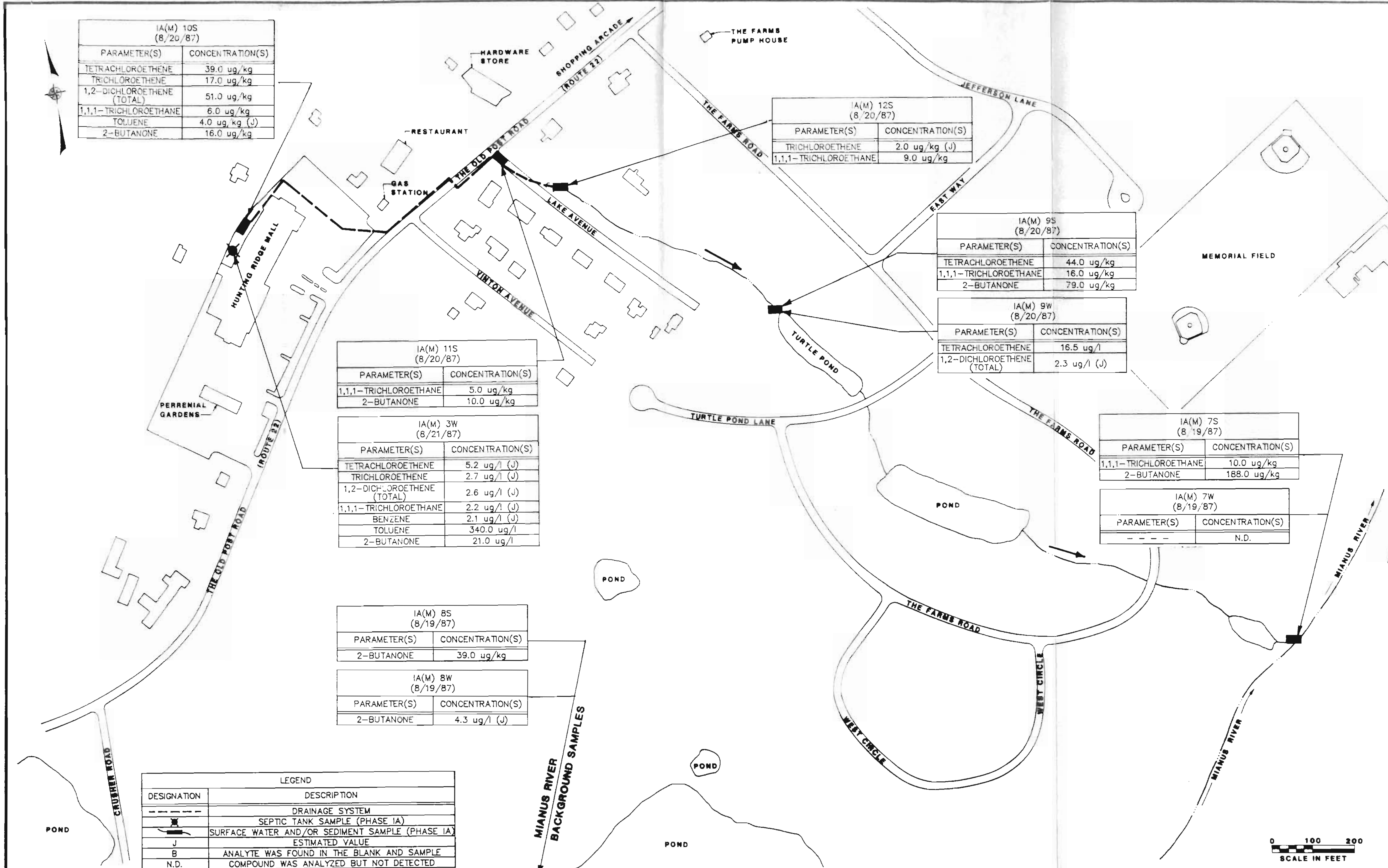
denotes water matrix

Sample Number IA (M) 14 W

denotes Hunting Ridge Mall Site

denotes sample location

This sample identification number was also used on the Chain-of-Custody Forms and Field Log Forms. As such, background information regarding each sampling location including, location sketches, field personnel involved, date and time of sample collection, meterological conditions, etc. can be obtained from the Field Log Forms which are contained in separate Field Report documents by cross referencing them to the appropriate sample identification number from Figure No. 3-3.



IA(M) 10S (8/20/87)

PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	39.0 ug/kg
TRICHLOROETHENE	17.0 ug/kg
1,2-DICHLOROETHENE (TOTAL)	51.0 ug/kg
1,1,1-TRICHLOROETHANE	6.0 ug/kg
TOLUENE	4.0 ug/kg (J)
2-BUTANONE	16.0 ug/kg

IA(M) 12S (8/20/87)

PARAMETER(S)	CONCENTRATION(S)
TRICHLOROETHENE	2.0 ug/kg (J)
1,1,1-TRICHLOROETHANE	9.0 ug/kg

IA(M) 9S (8/20/87)

PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	44.0 ug/kg
1,1,1-TRICHLOROETHANE	16.0 ug/kg
2-BUTANONE	79.0 ug/kg

IA(M) 9W (8/20/87)

PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	16.5 ug/l
1,2-DICHLOROETHENE (TOTAL)	2.3 ug/l (J)

IA(M) 11S (8/20/87)

PARAMETER(S)	CONCENTRATION(S)
1,1,1-TRICHLOROETHANE	5.0 ug/kg
2-BUTANONE	10.0 ug/kg

IA(M) 3W (8/21/87)

PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	5.2 ug/l (J)
TRICHLOROETHENE	2.7 ug/l (J)
1,2-DICHLOROETHENE (TOTAL)	2.6 ug/l (J)
1,1,1-TRICHLOROETHANE	2.2 ug/l (J)
BENZENE	2.1 ug/l (J)
TOLUENE	340.0 ug/l
2-BUTANONE	21.0 ug/l

IA(M) 7S (8/19/87)

PARAMETER(S)	CONCENTRATION(S)
1,1,1-TRICHLOROETHANE	10.0 ug/kg
2-BUTANONE	188.0 ug/kg

IA(M) 7W (8/19/87)

PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IA(M) 8S (8/19/87)

PARAMETER(S)	CONCENTRATION(S)
2-BUTANONE	39.0 ug/kg

IA(M) 8W (8/19/87)

PARAMETER(S)	CONCENTRATION(S)
2-BUTANONE	4.3 ug/l (J)

LEGEND

DESIGNATION	DESCRIPTION
— — — — —	DRAINAGE SYSTEM
	SEPTIC TANK SAMPLE (PHASE IA)
	SURFACE WATER AND/OR SEDIMENT SAMPLE (PHASE IA)
J	ESTIMATED VALUE
B	ANALYTE WAS FOUND IN THE BLANK AND SAMPLE
N.D.	COMPOUND WAS ANALYZED BUT NOT DETECTED

NO.	DATE	REVISION	INT.

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BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
PHASE I A
ORGANIC CHEMICAL SAMPLING RESULTS

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 3-3

In the following sections the sequence of data presentation will be by sampling media, beginning with potential sources such as septic tanks and continuing with stormwater drainage system sediment, surface water (stream and pond) and river sediments, and background sample points. For each media there is a discussion of organic (including the analytes of concern identified in Section 3.1.3) and inorganic sampling results as appropriate. As described previously, Figure No. 3-3 presents the location and identification numbers of each sampling location including the analytes of concern, along with the concentration detected. Cases where analytes of concern were reported as having non-detectable concentrations are reported as ND.

A summary of the organic and inorganic analytical results for all samples collected in the Hunting Ridge Mall Study Area during Phase IA is presented in tabular format in Table No. 3-2. Samples reporting results for inorganic analyses were analyzed for HSL constituents. All other samples were analyzed for VOCs only.

It is important to note that as shown in Table No. 3-2, multiple samples were obtained and analyzed at several locations during the Phase IA sampling program because some of the initial analyses did not meet NYSDEC QA/QC requirements and the results were deemed invalid. Therefore, only those analytical results that met the NYSDEC QA/QC requirements for Hazardous Substance List (HSL) analysis and resultant valid data is shown in both Table No. 3-2 and Figure No. 3-3, and presented in this report for discussion.

As listed in Table No. 3-2, where a compound was not measured in a sample, the data is presented using the following qualifiers:

- o A <u>blank</u> space indicates that the analysis of the compound did not meet the NYSDEC CLP QA/QC requirements and was therefore deemed <u>invalid</u> and not shown.

- o The symbol "ND" indicates that the analysis of this compound met the NYSDEC CLP QA/QC requirements, but was not measured above the analytical instrument's detection limits (IDL).

- o The symbol "NA" indicates that the compound was not analyzed.

Qualifiers that accompany the concentrations reported in the table are the NYSDEC CLP concentration qualifiers.

Table No. 3-2

BEDFORD VILLAGE
REMEDIAL INVESTIGATION / FEASIBILTY STUDY
HUNTING RIDGE MALL PHASE IA SAMPLING PROGRAM
ANALYTICAL RESULTS

PARAMETERS	IA(M)3W 8/21/87 ! (ug/l)	IA(M)3WA 6/1/88 * (ug/l)	IA(M)3WAA 3/3/89 (ug/l)	IA(M)7S 8/19/87 ! (ug/kg)	IA(M)7SA 5/31/88 (ug/kg)	IA(M)7W 8/19/87 ! (ug/l)	IA(M)7WA 5/31/88 (ug/l)
Volatiles:							
Acetone	283.0 JB	NA	NA	430.0 B	NA	17.0 B	NA
Benzene	2.1 J	NA	NA	ND	NA	ND	NA
Bromodichloromethane	ND	NA	NA	ND	NA	ND	NA
Bromoform	ND	NA	NA	ND	NA	ND	NA
Bromomethane	ND	NA	NA	ND	NA	ND	NA
2-Butanone	21.0	NA	NA	188.0	NA	ND	NA
Chlorobenzene	ND	NA	NA	ND	NA	ND	NA
Carbon Disulfide	ND	NA	NA	ND	NA	ND	NA
Carbon Tetrachloride	ND	NA	NA	ND	NA	ND	NA
Chloroethane	ND	NA	NA	ND	NA	ND	NA
Chloroform	2.7 J	NA	NA	ND	NA	ND	NA
Chloromethane	ND	NA	NA	ND	NA	ND	NA
Dibromochloromethane	ND	NA	NA	ND	NA	ND	NA
1,1-Dichloroethane	ND	NA	NA	ND	NA	ND	NA
1,2-Dichloroethane	ND	NA	NA	ND	NA	ND	NA
1,1-Dichloroethylene	ND	NA	NA	ND	NA	ND	NA
1,2-Dichloroethylene	2.6 J	NA	NA	ND	NA	ND	NA
1,2-Dichloropropane	ND	NA	NA	ND	NA	ND	NA
cis-1,3-Dichloropropene	ND	NA	NA	ND	NA	ND	NA
trans-1,3-Dichloropropene	ND	NA	NA	ND	NA	ND	NA
Ethyl Benzene	ND	NA	NA	ND	NA	ND	NA
2-Hexanone	ND	NA	NA	ND	NA	ND	NA
Methylene Chloride	160.0 B	NA	NA	37.0	NA	4.6 JB	NA
4-Methyl-2-Pentanone	ND	NA	NA	ND	NA	ND	NA
Styrene	ND	NA	NA	ND	NA	ND	NA
1,1,2,2-Tetrachloroethane	ND	NA	NA	ND	NA	ND	NA
Tetrachloroethylene	5.2 J	NA	NA	ND	NA	ND	NA
Toluene	340.0	NA	NA	ND	NA	ND	NA
1,1,1-Trichloroethane	2.2 J	NA	NA	10.0	NA	ND	NA
1,1,2-Trichloroethane	ND	NA	NA	ND	NA	ND	NA
Trichloroethene	2.7 J	NA	NA	ND	NA	ND	NA
Vinyl Acetate	ND	NA	NA	ND	NA	ND	NA
Vinyl Chloride	ND	NA	NA	ND	NA	ND	NA
Total Xylenes	ND	NA	NA	ND	NA	ND	NA
Other:							
Dimethyl Disulfide	6.0 J	NA	NA	ND	NA	ND	NA
2-Ethyl-1-Hexanol	ND	NA	NA	ND	NA	ND	NA
Hexane	ND	NA	NA	ND	NA	ND	NA
2,4-Dimethyl Phenol	ND	NA	NA	530.0 J	NA	ND	NA
Unknown Alkane (total)	ND	NA	NA	59.0 J	NA	ND	NA
Unknown (total)	4.0 J	NA	NA	ND	NA	ND	NA

Table No. 3-2 (continued)

PARAMETERS	IA(M)3W 8/21/87 ! (ug/l)	IA(M)3WA 6/1/88 * (ug/l)	IA(M)3WAA 3/3/89 (ug/l)	IA(M)7S 8/19/87 ! (ug/kg)	IA(M)7SA 5/31/88 (ug/kg)	IA(M)7W 8/19/87 ! (ug/l)	IA(M)7WA 5/31/88 (ug/l)
Semi-Volatiles:							
Acenaphthene	ND	NA	NA	ND	NA	ND	NA
Acenaphthylene	ND	NA	NA	ND	NA	ND	NA
Anthracene	ND	NA	NA	ND	NA	ND	NA
Benzo(a)anthracene	ND	NA	NA	ND	NA	ND	NA
Benzoic Acid	19.9	NA	NA	ND	NA	ND	NA
Benzyl Alcohol	ND	NA	NA	ND	NA	ND	NA
Benzo(b)fluoranthene	ND	NA	NA	ND	NA	ND	NA
Benzo(k)fluoranthene	ND	NA	NA	ND	NA	ND	NA
Benzo(g,h,i)perylene	ND	NA	NA	ND	NA	ND	NA
Benzo(a)pyrene	ND	NA	NA	ND	NA	ND	NA
4-Bromophenyl Phenyl Ether	ND	NA	NA	ND	NA	ND	NA
Butyl Benzyl Phthalate	ND	NA	NA	ND	NA	ND	NA
4-Chloroaniline	ND	NA	NA	ND	NA	ND	NA
bis (2-Chloroethoxy) methane	ND	NA	NA	ND	NA	ND	NA
bis (2-Chloroethyl) ether	ND	NA	NA	ND	NA	ND	NA
bis (2-Chloroisopropyl) ether	ND	NA	NA	ND	NA	ND	NA
4-Chloro-3-Methylphenol	ND	NA	NA	ND	NA	ND	NA
(p-chloro-m-cresol)	ND	NA	NA	ND	NA	ND	NA
2-Chloronaphthalene	ND	NA	NA	ND	NA	ND	NA
2-Chlorophenol	ND	NA	NA	ND	NA	ND	NA
4-Chlorophenyl Phenyl Ether	ND	NA	NA	ND	NA	ND	NA
Chrysene	ND	NA	NA	ND	NA	ND	NA
Dibenz(a,h)anthracene	ND	NA	NA	ND	NA	ND	NA
Dibenzofuran	ND	NA	NA	ND	NA	ND	NA
Di-n-butylphthalate	ND	NA	NA	ND	NA	3.5 J	NA
1,2-Dichlorobenzene	ND	NA	NA	ND	NA	ND	NA
1,3-Dichlorobenzene	ND	NA	NA	ND	NA	ND	NA
1,4-Dichlorobenzene	ND	NA	NA	ND	NA	ND	NA
3,3'-Dichlorobenzidine	ND	NA	NA	ND	NA	ND	NA
2,4-Dichlorophenol	ND	NA	NA	ND	NA	ND	NA
Diethylphthalate	ND	NA	NA	ND	NA	ND	NA
2,4-Dimethylphenol	ND	NA	NA	ND	NA	ND	NA
Dimethyl Phthalate	ND	NA	NA	ND	NA	ND	NA
4,6-Dinitro-2-Methyl Phenol	ND	NA	NA	ND	NA	ND	NA
2,4-Dinitrophenol	ND	NA	NA	ND	NA	ND	NA
2,4-Dinitrotoluene	ND	NA	NA	ND	NA	ND	NA
2,6-Dinitrotoluene	ND	NA	NA	ND	NA	ND	NA
Di-n-Octyl Phthalate	ND	NA	NA	ND	NA	ND	NA
bis (2-ethylhexyl) Phthalate	110.0	NA	NA	ND	NA	ND	NA
Fluoranthene	ND	NA	NA	ND	NA	ND	NA
Fluorene	ND	NA	NA	ND	NA	ND	NA
Hexachlorobenzene	ND	NA	NA	ND	NA	ND	NA
Hexachlorobutadiene	ND	NA	NA	ND	NA	ND	NA
Hexachlorocyclopentadiene	ND	NA	NA	ND	NA	ND	NA
Hexachloroethane	ND	NA	NA	ND	NA	ND	NA

Table No. 3-2 (continued)

PARAMETERS	IA(M)3W 8/21/87 ! (ug/l)	IA(M)3WA 6/1/88 * (ug/l)	IA(M)3WAA 3/3/89 (ug/l)	IA(M)7S 8/19/87 ! (ug/kg)	IA(M)7SA 5/31/88 (ug/kg)	IA(M)7W 8/19/87 ! (ug/l)	IA(M)7WA 5/31/88 (ug/l)
Indeno(1,2,3-cd)pyrene	ND	NA	NA	ND	NA	ND	NA
Isophorone	ND	NA	NA	ND	NA	ND	NA
2-Methylnaphthalene	ND	NA	NA	ND	NA	ND	NA
2-Methyl Phenol	ND	NA	NA	ND	NA	ND	NA
4-Methyl Phenol	473.0	NA	NA	ND	NA	ND	NA
Naphthalene	ND	NA	NA	ND	NA	ND	NA
2-Nitroaniline	ND	NA	NA	ND	NA	ND	NA
3-Nitroaniline	ND	NA	NA	ND	NA	ND	NA
4-Nitroaniline	ND	NA	NA	ND	NA	ND	NA
Nitrobenzene	ND	NA	NA	ND	NA	ND	NA
2-Nitrophenol	ND	NA	NA	ND	NA	ND	NA
4-Nitrophenol	ND	NA	NA	ND	NA	ND	NA
N-Nitroso-Diphenylamine	ND	NA	NA	ND	NA	ND	NA
N-Nitroso-Dipropylamine	ND	NA	NA	ND	NA	ND	NA
Pentachlorophenol	ND	NA	NA	ND	NA	ND	NA
Phenanthrene	ND	NA	NA	ND	NA	ND	NA
Phenol	44.0	NA	NA	ND	NA	ND	NA
Phenol (total)	149.8	NA	NA	300.0	NA	38.0	NA
Pyrene	ND	NA	NA	ND	NA	ND	NA
1,2,4-Trichlorobenzene	ND	NA	NA	ND	NA	ND	NA
2,4,5-Trichlorophenol	ND	NA	NA	ND	NA	ND	NA
2,4,6-Trichlorophenol	ND	NA	NA	ND	NA	ND	NA
Other:							

Acetic Acid	20.0 J	NA	NA	ND	NA	ND	NA
Furan	15.0 J	NA	NA	ND	NA	ND	NA
1H-Indole	30.0 J	NA	NA	ND	NA	ND	NA
1H-Indole,3-Methyl	20.0 J	NA	NA	ND	NA	ND	NA
Methoxyethane	80.0 J	NA	NA	ND	NA	ND	NA
Pentane,2,4-Dimethyl	490.0 J	NA	NA	ND	NA	ND	NA
2-Propanol,2-Methyl	ND	NA	NA	3800.0 J	NA	ND	NA
1-Propene	20.0 J	NA	NA	ND	NA	ND	NA
Unknown (total)	434.0 J	NA	NA	24300 J	NA	ND	NA
Unknown Alkane (total)	ND	NA	NA	9800.0 J	NA	ND	NA
Unknown Alkene (total)	ND	NA	NA	ND	ND	110.0 J	NA

Table No. 3-2 (continued)

PARAMETERS	IA(M)3W 8/21/87 ! (ug/l)	IA(M)3WA 6/1/88 * (ug/l)	IA(M)3WAA 3/3/89 (ug/l)	IA(M)7S 8/19/87 ! (mg/kg)	IA(M)7SA 5/31/88 (mg/kg)	IA(M)7W 8/19/87 ! (ug/l)	IA(M)7WA 5/31/88 (ug/l)
Inorganics:							
Aluminum	NR	NA	NA	NR	NA	NR	NA
Antimony	58.0 U	NA	NA	26.4 U	NA	58.0 U	NA
Arsenic	3.0 U	NA	NA	[1.5] N	NA	3.0 U	NA
Barium	NR	NA	NA	NR	NA	NR	NA
Beryllium	0.6 U	NA	NA	0.3 U	NA	0.6 U	NA
Cadmium	5.0 UN	NA	NA	2.3 U	NA	5.0 U	NA
Calcium	NR	NA	NA	NR	NA	NR	NA
Chromium	9.0 U	NA	NA	12.7	NA	9.0 U	NA
Cobalt	NR	NA	NA	NR	NA	NR	NA
Copper	318.0	NA	NA	[5.0] N	NA	3.0 U	NA
Cyanide	10.0 U	NA	NA	0.2 U	NA	10.0 U	NA
Iron	NR	NA	NA	NR	NA	NR	NA
Lead	5.0 UN	NA	NA	42.9 SN	NA	25.0 U	NA
Magnesium	NR	NA	NA	NR	NA	NR	NA
Manganese	NR	NA	NA	NR	NA	NR	NA
Mercury	0.6 N	NA	NA	0.2 U	NA	2.0 U	NA
Nickel	12.0 U	NA	NA	5.5 U	NA	12.0 U	NA
Potassium	NR	NA	NA	NR	NA	NR	NA
Selenium	5.0 U	NA	NA	11.4 U	NA	5.0 U	NA
Silver	39.0 N	NA	NA	4.5 U	NA	27.0 N	NA
Sodium	NR	NA	NA	NR	NA	NR	NA
Thallium	5.0 U	NA	NA	2.3 U	NA	5.0	NA
Vanadium	NR	NA	NA	NR	NA	NR	NA
Zinc	136.0	NA	NA	9.5	NA	7.0 U	NA

Table No. 3-2 (continued)

PARAMETERS	IA(M)3W 8/21/87 ! (ug/l)	IA(M)3WA 6/1/88 * (ug/l)	IA(M)3WAA 3/3/89 (ug/l)	IA(M)7S 8/19/87 ! (ug/kg)	IA(M)7SA 5/31/88 (ug/kg)	IA(M)7W 8/19/87 ! (ug/l)	IA(M)7WA 5/31/88 (ug/l)
Pesticides/PCBs:							
Aldrin			ND		ND		ND
AROCLOR-1016			ND		ND		ND
AROCLOR-1221			ND		ND		ND
AROCLOR-1232			ND		ND		ND
AROCLOR-1242			ND		ND		ND
AROCLOR-1248			ND		ND		ND
AROCLOR-1254			ND		ND		ND
AROCLOR-1260			ND		ND		ND
alpha-BHC			ND		ND		ND
beta-BHC			ND		ND		ND
delta-BHC			ND		ND		ND
gamma-BHC (Lindane)			ND		ND		ND
alpha-Chlordane			ND		ND		ND
gamma-Chlordane			ND		ND		ND
4,4'-DDD			ND		ND		ND
4,4'-DDE			ND		ND		ND
4,4'-DDT			ND		ND		ND
Dieldrin			ND		ND		ND
Endrin			ND		ND		ND
Endrin Ketone			ND		ND		ND
Endosulfan I			ND		ND		ND
Endosulfan II			ND		ND		ND
Endosulfan Sulfate			ND		ND		ND
Heptachlor			ND		ND		ND
Heptachlor Epoxide			ND		ND		ND
Methoxychlor			ND		ND		ND
Toxaphene			ND		ND		ND

U - Indicates compound was analyzed for but not detected.
Reported with the instrument detection limits
N - Indicates spike sample recovery is not within control limits.
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
* - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range on two of the evaluation standard runs
NR - Not required as an analyte by NYSDEC
! - Method blank noncompliance with NYSDEC clip
[] - Indicates sample value is between IDL and CRDL.
S - Indicates the reported value was determined by the method of standard addition.
NA - Not analyzed
ND - Not detected
blank space - Data is invalid

IA(M)03W - HRM Septic Tank
IA(M)07S/W - Confluence of Mianus River and Turtle Pond
IA(M)08S - Mianus River (Background)
IA(M)10S - HRM Drainage System

Table No. 3-2

BEDFORD VILLAGE
REMEDIAL INVESTIGATION / FEASIBILTY STUDY
HUNTING RIDGE MALL PHASE IA SAMPLING PROGRAM
ANALYTICAL RESULTS

PARAMETERS	IA(M)8S 8/19/87 (ug/kg)	IA(M)8W 8/19/87 (ug/l)	IA(M)9S 8/20/87 (ug/kg)	IA(M)9W 8/20/87 (ug/l)	IA(M)10S 8/20/87 (ug/kg)	IA(M)11S 8/20/87 (ug/kg)	IA(M)12S 8/20/87 (ug/kg)
Volatiles:							
Acetone	200.0 B	19.0 B	1200.0 B	4.1 J	36.0 B	101.0 B	87.0 B
Benzene	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND
2-Butanone	39.0	4.3 J	79.0	ND	16.0	10.0	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethylene	ND	ND	ND	2.3 J	51.0	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	5.0 B	28.0 B	40.0	4.7 J	4.0 JB	10.0 B	19.0 B
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	44.0	16.5	39.0	ND	ND
Toluene	ND	ND	ND	ND	4.0 J	ND	ND
1,1,1-Trichloroethane	ND	ND	16.0	ND	6.0	5.0	9.0
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	17.0	ND	2.0 J
Vinyl Acetate	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND
Other:							
Dimethyl Disulfide	ND	ND	ND	ND	12.0 J	ND	ND
2-Ethyl-1-Hexanol	ND	ND	ND	ND	7.0 J	ND	ND
Hexane	ND	4.0 J	ND	ND	ND	ND	ND
2,4-Dimethyl Phenol	ND	ND	1400.0 J	ND	ND	ND	ND
Unknown Alkane (total)	ND	ND	ND	ND	ND	ND	ND
Unknown (total)	ND	ND	ND	ND	ND	ND	ND

Table No. 3-2 (continued)

PARAMETERS	IA(M)8S 8/19/87 (ug/kg)	IA(M)8W 8/19/87 (ug/l)	IA(M)9S 8/20/87 (ug/kg)	IA(M)9W 8/20/87 (ug/l)	IA(M)10S 8/20/87 (ug/kg)	IA(M)11S 8/20/87 (ug/kg)	IA(M)12S 8/20/87 (ug/kg)
Semi-Volatiles:							
Acenaphthene	ND	NA	NA	NA	ND	NA	NA
Acenaphthylene	ND	NA	NA	NA	ND	NA	NA
Anthracene	ND	NA	NA	NA	ND	NA	NA
Benzo(a)anthracene	ND	NA	NA	NA	ND	NA	NA
Benzoic Acid	ND	NA	NA	NA	ND	NA	NA
Benzyl Alcohol	ND	NA	NA	NA	ND	NA	NA
Benzo(b)fluoranthene	ND	NA	NA	NA	ND	NA	NA
Benzo(k)fluoranthene	ND	NA	NA	NA	ND	NA	NA
Benzo(g,h,i)perylene	ND	NA	NA	NA	ND	NA	NA
Benzo(a)pyrene	ND	NA	NA	NA	ND	NA	NA
4-Bromophenyl Phenyl Ether	ND	NA	NA	NA	ND	NA	NA
Butyl Benzyl Phthalate	ND	NA	NA	NA	2100.0 B	NA	NA
4-Chloroaniline	ND	NA	NA	NA	ND	NA	NA
bis (2-Chloroethoxy) methane	ND	NA	NA	NA	ND	NA	NA
bis (2-Chloroethyl) ether	ND	NA	NA	NA	ND	NA	NA
bis (2-Chloroisopropyl) ether	ND	NA	NA	NA	ND	NA	NA
4-Chloro-3-Methylphenol	ND	NA	NA	NA	ND	NA	NA
(p-chloro-m-cresol)	ND	NA	NA	NA	ND	NA	NA
2-Chloronaphthalene	ND	NA	NA	NA	ND	NA	NA
2-Chlorophenol	ND	NA	NA	NA	ND	NA	NA
4-Chlorophenyl Phenyl Ether	ND	NA	NA	NA	ND	NA	NA
Chrysene	ND	NA	NA	NA	ND	NA	NA
Dibenz(a,h)anthracene	ND	NA	NA	NA	ND	NA	NA
Dibenzofuran	ND	NA	NA	NA	ND	NA	NA
Di-n-butylphthalate	ND	NA	NA	NA	260.0 JB	NA	NA
1,2-Dichlorobenzene	ND	NA	NA	NA	ND	NA	NA
1,3-Dichlorobenzene	ND	NA	NA	NA	ND	NA	NA
1,4-Dichlorobenzene	ND	NA	NA	NA	ND	NA	NA
3,3'-Dichlorobenzidine	ND	NA	NA	NA	ND	NA	NA
2,4-Dichlorophenol	ND	NA	NA	NA	ND	NA	NA
Diethylphthalate	ND	NA	NA	NA	ND	NA	NA
2,4-Dimethylphenol	ND	NA	NA	NA	ND	NA	NA
Dimethyl Phthalate	ND	NA	NA	NA	ND	NA	NA
4,6-Dinitro-2-Methyl Phenol	ND	NA	NA	NA	ND	NA	NA
2,4-Dinitrophenol	ND	NA	NA	NA	ND	NA	NA
2,4-Dinitrotoluene	ND	NA	NA	NA	ND	NA	NA
2,6-Dinitrotoluene	ND	NA	NA	NA	ND	NA	NA
Di-n-Octyl Phthalate	ND	NA	NA	NA	ND	NA	NA
bis (2-ethylhexyl) Phthalate	ND	NA	NA	NA	9900.0 B	NA	NA
Fluoranthene	ND	NA	NA	NA	400.0 JB	NA	NA
Fluorene	ND	NA	NA	NA	ND	NA	NA
Hexachlorobenzene	ND	NA	NA	NA	ND	NA	NA
Hexachlorobutadiene	ND	NA	NA	NA	ND	NA	NA
Hexachlorocyclopentadiene	ND	NA	NA	NA	ND	NA	NA
Hexachloroethane	ND	NA	NA	NA	ND	NA	NA

Table No. 3-2 (continued)

PARAMETERS	IA(M)8S 8/19/87 (ug/kg)	IA(M)8W 8/19/87 (ug/l)	IA(M)9S 8/20/87 (ug/kg)	IA(M)9W 8/20/87 (ug/l)	IA(M)10S 8/20/87 (ug/kg)	IA(M)11S 8/20/87 (ug/kg)	IA(M)12S 8/20/87 (ug/kg)
Indeno(1,2,3-cd)pyrene	ND	NA	NA	NA	ND	NA	NA
Isophorone	ND	NA	NA	NA	ND	NA	NA
2-Methylnaphthalene	ND	NA	NA	NA	ND	NA	NA
2-Methyl Phenol	ND	NA	NA	NA	ND	NA	NA
4-Methyl Phenol	ND	NA	NA	NA	ND	NA	NA
Naphthalene	ND	NA	NA	NA	ND	NA	NA
2-Nitroaniline	ND	NA	NA	NA	ND	NA	NA
3-Nitroaniline	ND	NA	NA	NA	ND	NA	NA
4-Nitroaniline	ND	NA	NA	NA	ND	NA	NA
Nitrobenzene	ND	NA	NA	NA	ND	NA	NA
2-Nitrophenol	ND	NA	NA	NA	ND	NA	NA
4-Nitrophenol	ND	NA	NA	NA	ND	NA	NA
N-Nitroso-Diphenylamine	ND	NA	NA	NA	ND	NA	NA
N-Nitroso-Dipropylamine	ND	NA	NA	NA	ND	NA	NA
Pentachlorophenol	ND	NA	NA	NA	ND	NA	NA
Phenanthrene	ND	NA	NA	NA	300.0 JB	NA	NA
Phenol	ND	NA	NA	NA	ND	NA	NA
Phenol (total)	ND	NA	NA	NA	ND	NA	NA
Pyrene	ND	NA	NA	NA	510.0 JB	NA	NA
1,2,4-Trichlorobenzene	ND	NA	NA	NA	ND	NA	NA
2,4,5-Trichlorophenol	ND	NA	NA	NA	ND	NA	NA
2,4,6-Trichlorophenol	ND	NA	NA	NA	ND	NA	NA
Other:							
Acetic Acid	ND	NA	NA	NA	ND	NA	NA
Furan	ND	NA	NA	NA	ND	NA	NA
1H-Indole	ND	NA	NA	NA	ND	NA	NA
1H-Indole,3-Methyl	ND	NA	NA	NA	ND	NA	NA
Methoxyethane	ND	NA	NA	NA	ND	NA	NA
Pentane,2,4-Dimethyl	ND	NA	NA	NA	ND	NA	NA
2-Propanol,2-Methyl	ND	NA	NA	NA	2700.0 J	NA	NA
1-Propene	ND	NA	NA	NA	ND	NA	NA
Unknown (total)	ND	NA	NA	NA	120000 J	NA	NA
Unknown Alkane (total)	ND	NA	NA	NA	6700 J	NA	NA
Unknown Alkene (total)	ND	NA	NA	NA	ND	NA	NA

Table No. 3-2 (continued)

PARAMETERS	IA(M)8S 8/19/87 (mg/kg)	IA(M)8W 8/19/87 (ug/l)	IA(M)9S 8/20/87 (mg/kg)	IA(M)9W 8/20/87 (ug/l)	IA(M)10S 8/20/87 (mg/kg)	IA(M)11S 8/20/87 (mg/kg)	IA(M)12S 8/20/87 (mg/kg)
Inorganics:							
Aluminum	NR	NA	NA	NA	NR	NA	NA
Antimony	15.7	NA	NA	NA	17.1 UN	NA	NA
Arsenic	0.8 U	NA	NA	NA	1.3 N	NA	NA
Barium	NR	NA	NA	NA	NR	NA	NA
Beryllium	0.2 U	NA	NA	NA	0.2 UN	NA	NA
Cadmium	1.4 U	NA	NA	NA	1.5 U	NA	NA
Calcium	NR	NA	NA	NA	NR	NA	NA
Chromium	10.3	NA	NA	NA	17.4	NA	NA
Cobalt	NR	NA	NA	NA	NR	NA	NA
Copper	22.7	NA	NA	NA	24.7	NA	NA
Cyanide	0.1	NA	NA	NA	0.1 U	NA	NA
Iron	NR	NA	NA	NA	NR	NA	NA
Lead	20.9	NA	NA	NA	32.1 N	NA	NA
Magnesium	NR	NA	NA	NA	NR	NA	NA
Manganese	NR	NA	NA	NA	NR	NA	NA
Mercury	0.1 U	NA	NA	NA	0.1 U	NA	NA
Nickel	8.1	NA	NA	NA	[10.6]	NA	NA
Potassium	NR	NA	NA	NA	NR	NA	NA
Selenium	6.8 U	NA	NA	NA	7.4 N	NA	NA
Silver	2.7 U	NA	NA	NA	7.1 N	NA	NA
Sodium	NR	NA	NA	NA	NR	NA	NA
Thallium	1.4 U	NA	NA	NA	1.5	NA	NA
Vanadium	NR	NA	NA	NA	NR	NA	NA
Zinc	46.2	NA	NA	NA	147.1	NA	NA

Table No. 3-2 (continued)

PARAMETERS	IA(M)8S 8/19/87 (ug/kg)	IA(M)8W 8/19/87 (ug/l)	IA(M)9S 8/20/87 (ug/kg)	IA(M)9W 8/20/87 (ug/l)	IA(M)10S 8/20/87 (ug/kg)	IA(M)11S 8/20/87 (ug/kg)	IA(M)12S 8/20/87 (ug/kg)
Pesticides/PCBs:							
Aldrin	NA	NA	NA	NA	ND	NA	NA
AROCLOR-1016	NA	NA	NA	NA	ND	NA	NA
AROCLOR-1221	NA	NA	NA	NA	ND	NA	NA
AROCLOR-1232	NA	NA	NA	NA	ND	NA	NA
AROCLOR-1242	NA	NA	NA	NA	ND	NA	NA
AROCLOR-1248	NA	NA	NA	NA	ND	NA	NA
AROCLOR-1254	NA	NA	NA	NA	ND	NA	NA
AROCLOR-1260	NA	NA	NA	NA	ND	NA	NA
alpha-BHC	NA	NA	NA	NA	ND	NA	NA
beta-BHC	NA	NA	NA	NA	ND	NA	NA
delta-BHC	NA	NA	NA	NA	ND	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	ND	NA	NA
alpha-Chlordane	NA	NA	NA	NA	ND	NA	NA
gamma-Chlordane	NA	NA	NA	NA	ND	NA	NA
4,4'-DDD	NA	NA	NA	NA	ND	NA	NA
4,4'-DDE	NA	NA	NA	NA	ND	NA	NA
4,4'-DDT	NA	NA	NA	NA	ND	NA	NA
Dieldrin	NA	NA	NA	NA	ND	NA	NA
Endrin	NA	NA	NA	NA	ND	NA	NA
Endrin Ketone	NA	NA	NA	NA	ND	NA	NA
Endosulfan I	NA	NA	NA	NA	ND	NA	NA
Endosulfan II	NA	NA	NA	NA	ND	NA	NA
Endosulfan Sulfate	NA	NA	NA	NA	ND	NA	NA
Heptachlor	NA	NA	NA	NA	ND	NA	NA
Heptachlor Epoxide	NA	NA	NA	NA	ND	NA	NA
Methoxychlor	NA	NA	NA	NA	ND	NA	NA
Toxaphene	NA	NA	NA	NA	ND	NA	NA

U - Indicates compound was analyzed for but not detected.
Reported with the instrument detection limits
N - Indicates spike sample recovery is not within control limits.
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
* - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range on two of the evaluation standard runs
NR - Not required as an analyte by NYSDEC
! - Method blank noncompliance with NYSDEC clip
[] - Indicates sample value is between IDL and CRDL.
S - Indicates the reported value was determined by the method of standard addition.
NA - Not analyzed
ND - Not detected
blank space - Data is invalid

IA(M)03W - HRM Septic Tank
IA(M)07S/W - Confluence of Mianus River and Turtle Pond
IA(M)08S - Mianus River (Background)
IA(M)10S - HRM Drainage System

Table No. 3-2 (continued)

PARAMETERS	Field Blank 8/19/87 (ug/l)	Trip Blank 8/19/87 (ug/l)	Field Blank 8/20/87 (ug/l)	Trip Blank 8/20/87 (ug/l)	Field Blank 8/21/87 (ug/l)	Trip Blank 8/21/87 (ug/l)	Trip Blank 5/31/88 (ug/l)	Field Blank 6/1/88 + (ug/l)	Trip Blank 6/1/88 + (ug/l)	Field Blank 3/3/89 (ug/l)	Trip Blank 3/3/89 (ug/l)
Volatiles:											
Acetone	24.0	43.0	19.7	5.8 J	ND	4.0 B	35.3 B			ND	ND
Benzene	ND	ND	ND	ND	1.2 J	ND	ND			ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND			ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
2-Butanone	ND	ND	ND	ND	19.7	ND	ND			ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND			ND	ND
Carbon Disulfide	ND	ND	ND	2.3 J	ND	ND	ND			ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND			ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND			ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND			ND	ND
1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND			ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND			ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND			ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND			ND	ND
Ethyl Benzene	ND	ND	ND	ND	ND	ND	ND			ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND			ND	ND
Methylene Chloride	11.0 B	17.0 B	7.1 B	8.7 B	4.6 J	3.0 B	5.9 B			ND	3.0 J
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND			ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND			ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND			ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND			ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	2.2 J	ND	ND			ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND			ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND			ND	ND
Vinyl Acetate	ND	ND	ND	ND	ND	ND	ND			ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND			ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND			ND	ND
Other:											
Unknown Alkane	ND	ND	ND	ND	ND	ND	ND			ND	ND

Table No. 3-2 (continued)

PARAMETERS	Field Blank 8/19/87 (ug/l)	Trip Blank 8/19/87 (ug/l)	Field Blank 8/20/87 (ug/l)	Trip Blank 8/20/87 (ug/l)	Field Blank 8/21/87 (ug/l)	Trip Blank 8/21/87 (ug/l)	Trip Blank 5/31/88 (ug/l)	Field Blank 6/1/88 (ug/l)	Trip Blank 6/1/88 (ug/l)	Field Blank 3/3/89 (ug/l)	Trip Blank 3/3/89 (ug/l)
Semi-Volatiles:											
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Benzoic Acid	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Benzyl Alcohol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
4-Bromophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
bis (2-Chloroethoxy) methane	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
bis (2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
bis (2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
4-Chloro-3-Methylphenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
(p-chloro-m-cresol)	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
4-Chlorophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Diethylphthalate	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
4,6-Dinitro-2-Methyl Phenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Di-n-octyl Phthalate	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
bis (2-ethylhexyl) Phthalate	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA

Table No. 3-2 (continued)

PARAMETERS	Field Blank 8/19/87 (ug/l)	Trip Blank 8/19/87 (ug/l)	Field Blank 8/20/87 (ug/l)	Trip Blank 8/20/87 (ug/l)	Field Blank 8/21/87 (ug/l)	Trip Blank 8/21/87 (ug/l)	Trip Blank 5/31/88 (ug/l)	Field Blank 6/1/88 (ug/l)	Trip Blank 6/1/88 (ug/l)	Field Blank 3/3/89 (ug/l)	Trip Blank 3/3/89 (ug/l)
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2-Methyl Phenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
4 Methyl Phenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
N-Nitroso-Diphenylamine	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
N-Nitroso-Dipropylamine	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Phenol (total)	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA

Other:

Table No. 3-2 (continued)

PARAMETERS	Field Blank 8/19/87 (ug/l)	Trip Blank 8/19/87 (ug/l)	Field Blank 8/20/87 (ug/l)	Trip Blank 8/20/87 (ug/l)	Field Blank 8/21/87 (ug/l)	Trip Blank 8/21/87 (ug/l)	Trip Blank 5/31/88 (ug/l)	Field Blank 6/1/88 (ug/l)	Trip Blank 6/1/88 (ug/l)	Field Blank 3/3/89 (ug/l)	Trip Blank 3/3/89 (ug/l)
Inorganics:											
Aluminum	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Calcium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA

Table No. 3-2 (continued)

PARAMETERS	Field Blank 8/19/87 (ug/l)	Trip Blank 8/19/87 (ug/l)	Field Blank 8/20/87 (ug/l)	Trip Blank 8/20/87 (ug/l)	Field Blank 8/21/87 (ug/l)	Trip Blank 8/21/87 (ug/l)	Trip Blank 5/31/88 (ug/l)	Field Blank 6/1/88 (ug/l)	Trip Blank 6/1/88 (ug/l)	Field Blank 3/3/89 (ug/l)	Trip Blank 3/3/89 (ug/l)
Pesticides/PCBs:											
Aldrin	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
AROCLOR-1016	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
AROCLOR-1221	NA	NA	NA	NA	NA.	NA	NA	ND	NA	NA	ND
AROCLOR-1232	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
AROCLOR-1242	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
AROCLOR-1248	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
AROCLOR-1254	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
AROCLOR-1260	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
alpha-BHC	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
beta-BHC	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
delta-BHC	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Dieldrin	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Endrin	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Endrin Ketone	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Endosulfan I	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Endosulfan Sulfate	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Heptachlor	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Heptachlor Epoxide	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Methoxychlor	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND
Toxaphene	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND

U - Indicates compound was analyzed for but not detected.
Reported with the instrument detection limits
N - Indicates spike sample recovery is not within control limits.
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
* - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range on two of the evaluation standard runs.
+ - Holding time exceeded for volatiles.
NR - Not required as an analyte by NYSDEC
! - Method blank noncompliance with NYSDEC clip
NA - Not analyzed
ND - Not detected
blank space - Data is invalid

In addition, several sample results show the presence of unknown isomers and "other" compounds. These compounds are listed in the table and presented in the text, however, identification and determination of the exact levels of the compounds, as well as a discussion of their presence and extent of contamination is not definable within the context of this program and will be excluded from discussion. In order to more clearly identify and define possible contamination by these compounds, additional sampling would be necessary with the primary focus of analysis based on these parameters.

3.2.1 Potential Source Investigation (Septic Tank)

As previously discussed, as a result of past disposal practices at a dry cleaning establishment located in the Hunting Ridge Mall, provision was made in the Phase IA sampling program to obtain four liquid matrix (septic tank effluent) samples from the leaching pools of the subsurface disposal system at the Mall and two solid matrix (septic tank sludge) samples from the primary settling tanks of the subsurface wastewater disposal system at the Mall. Subsequent to the approval of the Bedford Village Wells RI/FS contract and during the preparation of the Remedial Investigation Work Plan, it was learned that during the previous 12 to 18 months, the Westchester County Department of Health (WCDH) had required the owner of the Hunting Ridge Mall to design and install a new leaching system for the subsurface disposal system servicing the Mall. The leaching/tile field system was designed to replace the four leaching pools originally used to discharge septic tank effluent to subsurface soils behind the Mall.

During the design and regulatory approval of the replacement leaching system, the Mall owner was required by WCDH to pump and remove septic tank solids (sludge) and liquids off-site each day by utilizing a licensed New York State waste hauler. As a result, the primary and secondary septic tanks were completely devoid of sludge. Therefore, although attempts were made, it was not possible to obtain a sludge sample. Since the leaching pools had already been removed by the contractor, it was also not possible to obtain septic tank effluent samples from those units. In consultation with the NYSDEC Region-3 Field Supervisor, it was determined that it would be appropriate to obtain one liquid matrix sample (IA[M]3W) from the effluent pump chamber of the septic tank. It is this liquid which was pumped to the original leaching pools and would be representative of any samples obtained from the pools had they been in service.

3.2.1.1 Organic Sampling Results

The analytical results of sample IA(M)03W contained the following compounds: (Please note that the initial sample failed QA/QC requirements for pesticides/PCBs. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Analytes of Concern	Concentration (ug/l)
Tetrachloroethene	5.2 J
Trichloroethene	2.7 J
Trans-1,2-dichloroethene	2.6 J
1,1,1-Trichloroethane	2.2 J
Benzene	2.1 J
Toluene	340.0

Other Compounds	Concentration (ug/l)
Chloroform	2.7 J
Phenol	44.0
Phenol (total)	149.8
Bis(2-ethylhexyl)phthalate	110.0
Methylene chloride	160.0 B
2-Butanone	21.0
Acetone	283.0
4-Methylphenol	473.0
Benzoic acid	19.9
Unknown (total)	438.0 J
Dimethyl disulfide (total)	6.0 J
IH-Indole	30.0 J
IH-Indole,3-methyl	20.0 J
Furan	15.0 J
Acetic acid	20.0 J
Methoxyethane	80.0 J
1-Propene	20.0 J
Pentane,2,4-dimethyl	490.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

It should be noted that the compounds, chloroform, bis(2-ethylhexyl)phthalate, methylene chloride, acetone, as well as carbon disulfide, 1,1,2-trichloro-1,2,2-trifloro-ethane (freon), di-n-butylphthalate and a number of polynuclear aromatic hydrocarbons, including pyrene, fluoranthene and phenanthrene were often (if not always in the case of methylene chloride and acetone) found in trip blanks and field blanks and are most likely laboratory contaminants. As such, these compounds will not be specifically addressed (only listed) hereafter in this section or in the discussion of the analytical results in Section 6.0. Other compounds such as benzene and 2-butanone were also detected in a few trip blanks. However, because they were also found in a number of environmental samples while being absent in the blanks for the corresponding QA/QC samples, both benzene and 2-butanone are considered environmental contaminants.

3.2.1.2 Inorganic Sampling Results

Inorganic analyses conducted on the sample number IA(M)03W liquid matrix (effluent) collected from the septic tank serving the Hunting Ridge Mall detected the following metals:

Metal	Concentration (ug/l)
Copper	318.0
Zinc	136.0
Mercury	0.6 N
Silver	39.0 N

"N" indicates spiked sample recovery was not within control limits.

3.2.2 Stormwater Drainage System Sediment Investigation

The Phase IA drainage system sediment investigation was comprised of three sampling locations. The first location (IA[M]10S) is behind the Hunting Ridge Mall at the primary catch basin of the stormwater drainage system serving the Mall. The second location (IA[M]11S) is the catch basin located approximately 200 feet south of the intersection of Old Post Road (Route 22) and Lake Avenue and the third location (IA[M]12S) is at the point where the stormwater drainage pipe discharges to the stream bed east of Lake Avenue.

3.2.2.1 Organic Sampling Results

Sediment sample number 1A(M)10S, collected from the Hunting Ridge Mall primary catch basin contained the following organic compounds: (Please note that the initial sample failed QA/QC requirements for pesticides/PCBs. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Analytes of Concern	Concentration (ug/kg)
Tetrachloroethene	39.0
Trichloroethene	17.0
Trans-1,2-dichloroethene	51.0
1,1,1-Trichloroethane	6.0
Toluene	4.0 J

Other Compounds	Concentration (ug/kg)
Acetone	36.0 B
Methylene chloride	4.0 JB
2-Butanone	16.0
Bis(2-ethylhexyl)pthalate	9,900.0 B
Pyrene	510.0 JB
Phenanthrene	300.0 JB
Di-n-butylphthalate	260.0 JB
Fluoranthene	400.0 JB
Butyl benzyl phthalate	2,100.0 B
Dimethyl disulfide	12.0 J
2-Propanol, 2-methyl	2,700.0 J
2-Ethyl-1-hexanol	7.0 J
Unknown (total)	120,000.0 J
Unknown alkane (total)	6,700.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample numbers IA(M)11S collected from the drainage system/catch basin on Lake Avenue contained:

Analytes of Concern	Concentration (ug/kg)
1,1,1-Trichloroethane	5.0

Other Compounds	Concentration (ug/kg)
2-Butanone	10.0
Methylene chloride	10.0 B
Acetone	101.0 B

"B" indicates compound found in method blank.

Sediment sample number IA(M)12S collected from the drainage system discharge to the stream bed east of Lake Avenue contained:

Analytes of Concern	Concentration (ug/kg)
Trichloroethene	2.0 J
1,1,1-Trichloroethane	9.0

Other Compounds	Concentration (ug/kg)
Methylene chloride	19.0 B
Acetone	87.0 B

"J" indicates estimated value.
"B" indicates compound found in method blank.

3.2.2.2 Inorganic Sampling Results

Inorganic analyses were conducted on one sample collected from the drainage system in the Hunting Ridge Mall Study Area. Sediment sample number IA(M)10S, collected from the primary catch basin located behind the Mall contained the following inorganic constituents:

Constituent	Concentration (mg/kg)
Arsenic	1.3
Chromium	17.4
Copper	24.7
Lead	32.1
Nickel	[10.6]
Selenium	7.4
Silver	7.1
Thallium	1.5
Zinc	147.1

"[ ]" indicates the reported value is between the Contract Required Detection Limit (CRDL) and the Instrument Detection Limit (IDL).

3.2.3 Surface Water Investigation (Stream and Ponds)

For the purposes of this presentation of analytical results, the surface water investigation in the Hunting Ridge Mall Study Area will begin with sample number IA(M)09W which is located at the head of Turtle Pond. Turtle Pond is the first naturally occurring permanent surface water body located downstream of the Mall and receives the majority of the stormwater flows generated from within the study area. Sample number IA(M)07W is located at the confluence of the outlet from Turtle Pond and the Mianus River. Sample number IA(A)08W is located at the confluence of the Mianus River and the outlet from the wetlands in the Shopping Arcade Site Study Area, and sample number IA(A)09W is located in the Mianus River at Middle Patent Road. These latter two sampling points are addressed as part of the Shopping Arcade Site Remedial Investigation Report contained in a separate document. One additional surface water sample number IA(M)08W was obtained from the Mianus River at a point approximately 400 feet east of the intersection of Greenwich Road and Millbrook Road in the Hunting Ridge Mall Study Area. This sample location was selected as a background location and will be discussed as part of Section 3.2.5 (Background Sampling Points).

3.2.3.1 Organic Sampling Results

Of the surface water samples collected as part of the Hunting Ridge Mall Study Area [IA(M)09W, IA(M)07W and IA(M)08W], only sample number IA(M)09W, which is the sample collected at the inlet to Turtle Pond, contained the following analytes of concern:

Analytes of Concern	Concentration (ug/l)
Tetrachloroethene	16.5
Trans-1,2-dichloroethene	2.3 J

Other Compounds	Concentration (ug/l)
Acetone	4.1 J
Methylene chloride	4.7 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sample number IA(M)07W did not contain any analytes of concern. However, the following organic compounds were detected: (Please note that the initial sample failed QA/QC requirements for pesticides/PCBs. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Acetone	17.0 B
Methylene chloride	4.6 JB
Di-n-butylphthalate	3.5 J
Phenol (total)	38.0
Unknown alkene (total)	110.0 J

Organic analyses performed on sample IA(M)08W revealed that the following compounds were detected, none of which were analytes of concern.

Compound	Concentration (ug/l)
Acetone	19.0 B
2-Butanone	4.3 J
Methylene chloride	28.0 B
Hexane	4.0 J

3.2.3.2 Inorganic Sampling Results

Of the surface water samples collected as part of the Hunting Ridge Mall Study Area [IA(M)09W, IA(M)07W and IA(M)08W] only IA(M)07W was analyzed for inorganic chemicals. Sample number IA(M)07W contained the following metals:

Metal	Concentration (ug/l)
Silver	27.0 N
Thallium	5.0

"N" indicates spike sample recovery was not within control limits.

3.2.4 Surface Water Sediment Investigation (Stream and Ponds)

The analyses of sediment throughout the Hunting Ridge Mall Study Area during Phase IA were obtained from two sources. First, sediment samples were obtained and analyzed from the stormwater drainage system serving portions of the Hunting Ridge Mall, Route 22 and Lake Avenue as discussed in Section 3.3.2 above, and second, sediment samples were obtained from naturally occurring stream and pond system draining the Hunting Ridge Mall and the study area. Background/control sampling point IA(M)08S is discussed in Section 3.2.5.

3.2.4.1 Organic Sampling Results

Sediment sample number IA(M)09S collected from the head of Turtle Pond contained:

Analytes of Concern	Concentration (ug/kg)
Tetrachloroethene	44.0
1,1,1-Trichloroethane	16.0

Other Compounds	Concentration (ug/kg)
2-Butanone	79.0
Methylene chloride	40.0
Acetone	1,200.0 B
2,4-Dimethylphenol	1,400.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample number IA(M)07S was collected at the confluence of the outlet from Turtle Pond and the Mianus River and detected the following organic compounds: (Please note that the initial sample failed QA/QC requirements for pesticides/PCBs. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Analytes of Concern	Concentration (ug/kg)
1,1,1-Trichloroethane	10.0

Other Compounds	Concentration (ug/kg)
2-Butanone	188.0
Acetone	430.0 B
Methylene chloride	37.0
Phenol (total)	300.0
2,4-Dimethylphenol	530.0 J
2-Propanol,2-methyl	3,800.0 J
Unknown alkane (total)	9,859.0 J
Unknown (total)	24,300.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

3.2.4.2 Inorganic Sampling Results

Inorganic analyses were not conducted on the solid matrix (sediment) sample number IA(M)09S collected from the head of Turtle Pond. However, inorganic analyses were conducted on sample number IA(M)07S and was found to contain the following inorganic constituents:

Constituent	Concentration (mg/kg)
Arsenic	[1.5] N
Chromium	12.7
Copper	[5.0] N
Lead	42.9 SN
Zinc	9.5

"S" indicates a value was determined by MSA.
"N" indicates spike sample recovery was not within control limits.
"[ ]" indicates the reported value is between the CRDL and IDL.

3.2.5 Background/Control Sampling Points

The stormwater drainage system of the Hunting Ridge Mall acts as the "headwater" of the Turtle Pond drainage basin. The natural drainage system consists of the intermittent stream along the east side of Lake Avenue, the inlet to Turtle Pond, Turtle Pond and the outlet from the pond that flows south through two other unnamed ponds towards the Mianus River. Since the Mall is considered a source of past contamination and is upstream in the study area, a background surface water sampling point should theoretically be located upgradient from its location. However, since the most upstream portion of this drainage system is not a surface water source, it was not possible to locate a surface water sampling point immediately upstream of the Mall.

The study area is drained by the Mianus River. A control sampling point was located upstream in the river at a point approximately 400 feet east of the intersection of Greenwich Road and Millbrook Road. Samples obtained at this location were IA(M)08S (sediment) and IA(M)08W (surface water). The analytical results of these samples showed that they contained the following organic compounds.

3.2.5.1 Organic Sampling Results

Organic analyses conducted on sample IA(M)08W revealed the following compounds, none of which were the analytes of concern.

Compound	Concentration (ug/l)
Methylene chloride	28.0 B
Acetone	19.0 B
2–Butanone	4.3 J
Hexane	4.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Organic analytical results for sample IA(M)08S detected the compounds listed below. Again, none of the analytes of concern were detected. (Please note that the initial sample failed QA/QC requirements for pesticides/PCBs. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/kg)
Methylene chloride	5.0 B
Acetone	200.0 B
2-Butanone	39.0

"B" indicates compound found in method blank.

3.3 Description of the Phase IB Sampling Program

This section presents in detailed narrative and tabular format the specific components and associated activities of the Phase IB sampling program. The data collected from this phase of the sampling program assisted in determining the design of the IIB component of the remedial investigation.

The objective of the second phase (Phase IB) of the source/surficial sampling program was to provide additional data regarding the source and extent of contamination within the study area. Some of the locations sampled in the first phase of sampling (Phase IA) exhibited slightly elevated concentrations of contaminants. It was the purpose of the Phase IA investigation to sample a broad range of locations to make an initial determination of contamination location, type and concentration. Based on that analytical data, Phase IB was designed to target these locations and additional locations to provide confirmatory data.

Environmental sampling was undertaken at the following general locations:

- Septic tank (sludge)
- Septic tank (supernatant)
- Stormwater drainage system sediment
- Surface water (pond)
- Surface water sediment (stream and pond)

3.3.1 Sample Collection Methods

Methods for collection, preservation and handling of sediment and sludge, and surface water and supernatant in the Phase IB sampling program and decontamination of sampling equipment are the same as those described for the Phase IA program in Section 3.1.1.

3.3.2 Selection of Sampling Locations and Sample Points

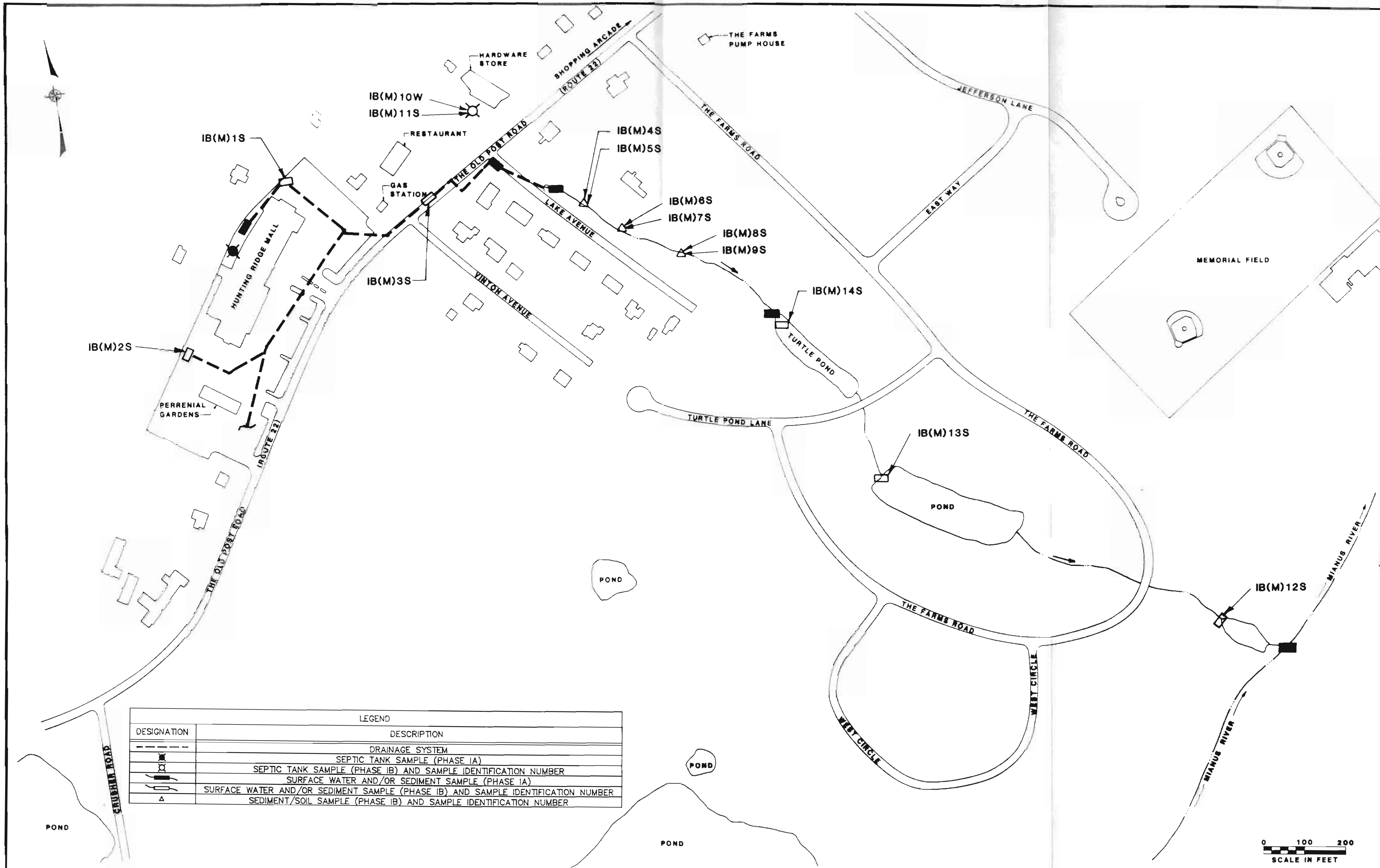
This section briefly reviews the rationale for the selection of various Phase IB sampling locations for the Hunting Ridge Mall Study Area. These sampling locations are illustrated on Figure No. 3-4.

Septic Tank Sludge and Supernatant - The data validation procedure noted that there was a problem with the quality control exercised by the laboratory in the analysis of the Phase IA sample obtained from the septic tank at the Hunting Ridge Mall. At the request of the NYSDEC, the Hunting Ridge Mall septic tank was re-sampled. In addition, as a result of samples collected during Phase IA, it was suspected that the hardware store sanitary system may be a contributing source of contamination in the study area. Sampling the contents of this subsurface disposal system assisted in determining if the system was once a source of contamination and/or if it is a present source of contamination.

Provisions were made in the Phase IB sampling program to obtain one supernatant and one sludge sample from the hardware store septic tank.

Stormwater Drainage System Sediment - In the Phase IA sampling program, a limited number of sediment samples were obtained from the stormwater drainage system underlying the Hunting Ridge Mall and Route 22 which discharges to an open culvert/stream bed along the east side of Lake Avenue. A sample was also obtained from within the stream bed along Lake Avenue in the immediate area to which the drainage system discharges. Analysis of these samples obtained in Phase IA indicated the presence of volatile organic compounds in the sediment.

Provision was made in the Phase IB sampling program to collect additional samples from sections of the Hunting Ridge Mall and Route 22 stormwater drainage system that had not been previously sampled. The streambed along Lake Avenue which receives the stormwater discharge was also selected for more extensive sampling in the Phase IB program to determine the effectiveness of the removal of contaminated sediment from the stream bed in 1983, and to evaluate the impacts of more recent sources of contamination.



LEGEND

DESIGNATION	DESCRIPTION
— — — —	DRAINAGE SYSTEM
	SEPTIC TANK SAMPLE (PHASE IA)
	SEPTIC TANK SAMPLE (PHASE IB) AND SAMPLE IDENTIFICATION NUMBER
	SURFACE WATER AND/OR SEDIMENT SAMPLE (PHASE IA)
	SURFACE WATER AND/OR SEDIMENT SAMPLE (PHASE IB) AND SAMPLE IDENTIFICATION NUMBER
Δ	SEDIMENT/SOIL SAMPLE (PHASE IB) AND SAMPLE IDENTIFICATION NUMBER

NO.	DATE	REVISION	INT.

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REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
PHASE IB SAMPLING LOCATIONS

PROJECT NO. 842
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SCALE AS NOTED
DRAWING NO. 3-4

Surface Water (Pond) - The data validation procedure noted that there was a problem with the quality control exercised by the laboratory in the analysis of the sample of the surface water discharge from the stream/pond drainage system into the Mianus River that was collected during the Phase IA sampling program. (There was also a quality control problem noted for the sediment sample obtained at this location.) At the direction of the NYSDEC, provision was included in the Phase IB program to re-sample the surface water and sediments at this location.

Surface Water Sediment (Pond) - In Phase IA, a sample was collected from the sediment in Turtle Pond. Laboratory analysis indicated the presence of volatile organic compounds in this sample. As a result, provision was made in the Phase IB sampling program to expand upon the sediment sampling in the pond system that discharges to the Mianus River to determine if this is a potential source (reservoir) of continuing contaminant release.

Table No. 3-3 summarizes the number and types of samples collected at each location as part of the Phase IB program.

3.3.3 Analytes of Concern

For all Phase IB samples obtained, laboratory analysis was conducted to determine the presence of volatile organic chemicals including tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, 1,1,1-trichloroethane and the BTX compounds. In addition, a select number of samples were analyzed for the Hazardous Substances List (HSL) compounds.

3.4 Analytical Results of the Phase IB Sampling Program

The purpose of this section is to present the analytical results which were collected during the Phase IB component of the Remedial Investigation. As was presented in the previous section, provision was made to collect solid and liquid matrix samples at specific locations throughout the Hunting Ridge Mall Study Area. The purpose of obtaining and analyzing these samples was threefold. First, the samples would confirm and expand upon previous analytical results obtained in Phase IA. Secondly, the results of the sampling effort would assist in the design of future phases of the sampling program (if required), and third, the evaluation of the data would assist in determining how the analytes of concern are moving through the environment of the study area and confirm possible sources of contamination.

Table No. 3–3

SUMMARY OF PHASE IB SAMPLING PROGRAM

Sampling Location	Number of Samples	Sample Identification Number	Rationale
Septic Tank (Sludge)	1	IB(M)11S	Determine if sludge in the septic tank at the hardware store is a source of ground water contamination as a result of present and past disposal practices.
Septic Tank (Supernatant)	2	IB(M)10W IA(M)3W–A (resample)	Determine if septage/effluent at the Mall and hardware store is a source of ground water contamination due to present and past disposal practices.
Stormwater Drainage System Sediment	9	IB(M)1S IB(M)2S IB(M)3S IB(M)4S IB(M)5S IB(M)6S IB(M)7S IB(M)8S IB(M)9S	Determine if the drainage system is contributing to ground water or surface water contamination in the study area.
Surface Water (Pond)	1	IA(M)7W–A (resample)	Determine if contamination exists in surface water in the pond/stream system that discharges to the Mianus River.
Surface Water Sediment (Pond)	4	IB(M)12S IB(M)13S IB(M)14S IA(M)7S–A (resample)	Determine the extent of contamination in Turtle Pond and the two unnamed down-stream ponds due to waste disposal in the study area.

Figure No. 3-5 presents a map of the study area which identifies the locations throughout the Hunting Ridge Mall Site from which solid (sludge/sediment) and liquid (wastewater/surface water) matrix samples were collected during the Phase IB program, along with the analytical results of each sample. For purposes of presenting the sampling program results, each sampling point was identified by an identification number. For example, a sampling point labelled "IB(M)14W" would indicate the following: The "IB" portion of the identification number indicates that the sample was collected during the Phase IB portion of the sampling program. The remainder of the sample identification number is described in Section 3.2.

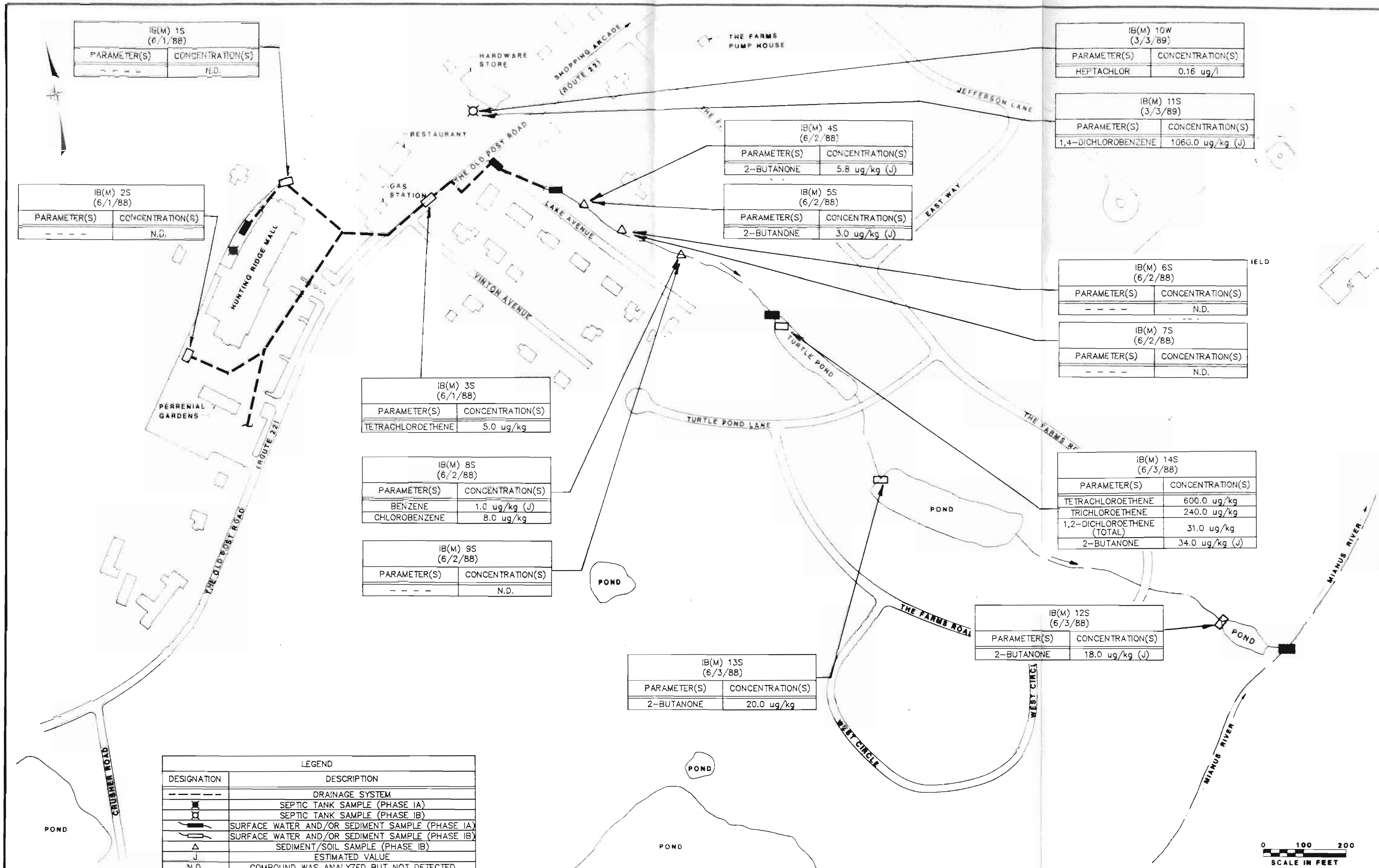
Similar to the results for Phase IA, in the following sections the sequence of data presentation for the Phase IB results will be by sampling media, beginning with potential sources such as septic tanks and continuing with drainage system sediment, surface water and pond sediments. For each media there will be a presentation of organic and inorganic sampling results as appropriate.

A summary of the Phase IB organic and inorganic analytical results of samples collected in the Hunting Ridge Mall Study Area are presented in tabular format in Table No. 3-4. Samples reporting results for inorganic analyses were also analyzed for pesticides/PCBs, volatiles and semi-volatiles. All other samples were analyzed for volatiles only.

It is important to note that as shown in Table No. 3-4, multiple samples were obtained and analyzed at several locations during the Phase IB sampling program because some of the initial analyses did not meet NYSDEC QA/QC requirements for Hazardous Substance List (HSL) analysis and the results were deemed invalid. All resampling results were analyzed for Target Compound List (TCL) constituents (see Appendix B for a list of TCL constituents). Therefore, only those analytical results that met the NYSDEC QA/QC requirements for HSL and/or TCL analysis and resultant valid data is shown in both Table No. 3-4 and Figure No. 3-5, and presented in this report for discussion.

As listed in Table No. 3-4, where a compound was not measured in a sample, the data is presented using the following qualifiers:

- o A <u>blank</u> space indicates that the analysis of the compound did not meet the NYSDEC CLP QA/QC requirements and was therefore deemed <u>invalid</u> and not shown.



IB(M) 1S (6/1/88)

PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IB(M) 2S (6/1/88)

PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IB(M) 3S (6/1/88)

PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	5.0 ug/kg

IB(M) 4S (6/2/88)

PARAMETER(S)	CONCENTRATION(S)
2-BUTANONE	5.8 ug/kg (J)

IB(M) 5S (6/2/88)

PARAMETER(S)	CONCENTRATION(S)
2-BUTANONE	3.0 ug/kg (J)

IB(M) 6S (6/2/88)

PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IB(M) 7S (6/2/88)

PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IB(M) 8S (6/2/88)

PARAMETER(S)	CONCENTRATION(S)
BENZENE	1.0 ug/kg (J)
CHLOROBENZENE	8.0 ug/kg

IB(M) 9S (6/2/88)

PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IB(M) 10W (3/3/89)

PARAMETER(S)	CONCENTRATION(S)
HEPTACHLOR	0.16 ug/l

IB(M) 11S (3/3/89)

PARAMETER(S)	CONCENTRATION(S)
1,4-DICHLOROBENZENE	1060.0 ug/kg (J)

IB(M) 12S (6/3/88)

PARAMETER(S)	CONCENTRATION(S)
2-BUTANONE	18.0 ug/kg (J)

IB(M) 13S (6/3/88)

PARAMETER(S)	CONCENTRATION(S)
2-BUTANONE	20.0 ug/kg

IB(M) 14S (6/3/88)

PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	600.0 ug/kg
TRICHLOROETHENE	240.0 ug/kg
1,2-DICHLOROETHENE (TOTAL)	31.0 ug/kg
2-BUTANONE	34.0 ug/kg (J)

LEGEND

DESIGNATION	DESCRIPTION
— — — —	DRAINAGE SYSTEM
	SEPTIC TANK SAMPLE (PHASE IA)
	SEPTIC TANK SAMPLE (PHASE IB)
	SURFACE WATER AND/OR SEDIMENT SAMPLE (PHASE IA)
	SURFACE WATER AND/OR SEDIMENT SAMPLE (PHASE IB)
△	SEDIMENT/SOIL SAMPLE (PHASE IB)
J	ESTIMATED VALUE
N.D.	COMPOUND WAS ANALYZED BUT NOT DETECTED

NO.	DATE	REVISION	BY

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BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
PHASE IB
ORGANIC CHEMICAL SAMPLING RESULTS

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 3-5

Table No. 3-4

BEDFORD VILLAGE
REMEDIAL INVESTIGATION / FEASIBILTY STUDY
HUNTING RIDGE MALL PHASE IB SAMPLING PROGRAM
ANALYTICAL RESULTS

PARAMETERS	IB(M)1S 6/1/88 ft (ug/kg)	IB(M)2S 6/1/88 ft (ug/kg)	IB(M)3S 6/1/88 ft (ug/kg)	IB(M)4S 6/2/88 ft (ug/kg)	IB(M)5S 6/2/88 ft (ug/kg)	IB(M)6S 6/2/88 ft (ug/kg)	IB(M)7S 6/2/88 ft (ug/kg)	IB(M)8S 6/2/88 ft (ug/kg)	IB(M)9S 6/2/88 ft (ug/kg)
Volatiles:									
Acetone	39.0 B	44.0 B	9.0 B	93.0 B	66.0 B	32.0 B	66.0 B	35.0 B	5500.0 B
Benzene	ND	ND	ND	ND	ND	ND	ND	1.0 J	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	5.8 J	3.0 J	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	8.0	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	9.0 B	8.0 B	7.0 B	11.0 B	11.0 B	5.7 B	6.2 B	9.0 B	860.0 B
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	5.0	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Acetate	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND
Other:									
1,1,2-Trichloro-1,2,2-Tri-Fluoro-Ethane	ND	ND	ND	ND	ND	ND	ND	ND	2500.0 JB
Unknown (total)	ND	5.0 J	ND	ND	473.0 J	ND	ND	ND	3500.0 J
Unknown Alkane (total)	ND	ND	ND	ND	ND	ND	15.0 J	150.0 J	4000.0 J
Unknown Alkene (total)	ND	ND	ND	ND	231.0 J	ND	ND	ND	ND

Table No. 3-4 (continued)

PARAMETERS	IB(M)1S 6/1/88 ft (ug/kg)	IB(M)2S 6/1/88 ft (ug/kg)	IB(M)3S 6/1/88 ft (ug/kg)	IB(M)4S 6/2/88 ft (ug/kg)	IB(M)5S 6/2/88 ft (ug/kg)	IB(M)6S 6/2/88 ft (ug/kg)	IB(M)7S 6/2/88 ft (ug/kg)	IB(M)8S 6/2/88 ft (ug/kg)	IB(M)9S 6/2/88 ft (ug/kg)
Semi-Volatiles:									
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzoic Acid	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis (2-Chloroethoxy) methane	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis (2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis (2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol (p-chloro-m-cresol)	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methyl Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Octyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis (2-ethylhexyl) Phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table No. 3-4 (continued)

PARAMETERS	IB(M)1S 6/1/88 ft (ug/kg)	IB(M)2S 6/1/88 ft (ug/kg)	IB(M)3S 6/1/88 ft (ug/kg)	IB(M)4S 6/2/88 ft (ug/kg)	IB(M)5S 6/2/88 ft (ug/kg)	IB(M)6S 6/2/88 ft (ug/kg)	IB(M)7S 6/2/88 ft (ug/kg)	IB(M)8S 6/2/88 ft (ug/kg)	IB(M)9S 6/2/88 ft (ug/kg)
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methyl Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Diphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Dipropylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA

Other:

Table No. 3-4 (continued)

PARAMETERS	IB(M)1S 6/1/88 ft (mg/kg)	IB(M)2S 6/1/88 ft (mg/kg)	IB(M)3S 6/1/88 ft (mg/kg)	IB(M)4S 6/2/88 ft (mg/kg)	IB(M)5S 6/2/88 ft (mg/kg)	IB(M)6S 6/2/88 ft (mg/kg)	IB(M)7S 6/2/88 ft (mg/kg)	IB(M)8S 6/2/88 ft (mg/kg)	IB(M)9S 6/2/88 ft (mg/kg)
Inorganics:									
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table No. 3-4 (continued)

PARAMETERS	IB(M)1S 6/1/88 ft (ug/kg)	IB(M)2S 6/1/88 ft (ug/kg)	IB(M)3S 6/1/88 ft (ug/kg)	IB(M)4S 6/2/88 ft (ug/kg)	IB(M)5S 6/2/88 ft (ug/kg)	IB(M)6S 6/2/88 ft (ug/kg)	IB(M)7S 6/2/88 ft (ug/kg)	IB(M)8S 6/2/88 ft (ug/kg)	IB(M)9S 6/2/88 ft (ug/kg)
Pesticides/PCBs:									
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA
AROCLOR-1016	NA	NA	NA	NA	NA	NA	NA	NA	NA
AROCLOR-1221	NA	NA	NA	NA	NA	NA	NA	NA	NA
AROCLOR-1232	NA	NA	NA	NA	NA	NA	NA	NA	NA
AROCLOR-1242	NA	NA	NA	NA	NA	NA	NA	NA	NA
AROCLOR-1248	NA	NA	NA	NA	NA	NA	NA	NA	NA
AROCLOR-1254	NA	NA	NA	NA	NA	NA	NA	NA	NA
AROCLOR-1260	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin ketone	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA	NA

J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
* - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range on two of the evaluation standard runs.
S - Surrogate spike
+ - Holding time exceeded for volatiles
ft - Holding time for field/trip blanks exceeded for volatiles
NA - Not analyzed
ND - Not detected
blank space - Data is invalid

Table No. 3-4 (continued)

PARAMETERS	IB(M)10W 6/3/88 ** (ug/l)	IB(M)10WB 3/3/89 (ug/l)	IB(M)11S 6/3/88 ** (ug/kg)	IB(M)11SB 3/3/89 (ug/kg)	IB(M)12S 6/3/88 ft (ug/kg)	IB(M)13S 6/3/88 ft (ug/kg)	IB(M)14S 6/3/88 ft (ug/kg)
Volatiles:							
Acetone		ND		3100.0 D	91.0 B	130.0 B	430.0 B
Benzene		ND		ND	ND	ND	ND
Bromodichloromethane		ND		ND	ND	ND	ND
Bromoform		ND		ND	ND	ND	ND
Bromomethane		ND		ND	ND	ND	ND
2-Butanone		ND		ND	18.0 J	20.0	34.0 J
Chlorobenzene		ND		ND	ND	ND	ND
Carbon Disulfide		ND		ND	ND	13.0	7.0
Carbon Tetrachloride		ND		ND	ND	ND	ND
Chloroethane		ND		ND	ND	ND	ND
Chloroform		ND		ND	ND	ND	ND
Chloromethane		ND		ND	ND	ND	ND
Dibromochloromethane		ND		ND	ND	ND	ND
1,1-Dichloroethane		ND		ND	ND	ND	ND
1,2-Dichloroethane		ND		ND	ND	ND	ND
1,1-Dichloroethylene		ND		ND	ND	ND	ND
1,2-Dichloroethylene		ND		ND	ND	ND	31.0
1,2-Dichloropropane		ND		ND	ND	ND	ND
cis-1,3-Dichloropropene		ND		ND	ND	ND	ND
trans-1,3-Dichloropropene		ND		ND	ND	ND	ND
Ethyl Benzene		ND		ND	ND	ND	ND
2-Hexanone		ND		ND	83.0	ND	ND
Methylene Chloride		ND		ND	15.0 B	10.0 B	68.0 B
4-Methyl-2-Pentanone		ND		ND	200.0	ND	ND
Styrene		ND		ND	ND	ND	ND
1,1,2,2-Tetrachloroethane		ND		ND	ND	ND	ND
Tetrachloroethylene		ND		ND	ND	ND	600.0
Toluene		ND		ND	ND	ND	ND
1,1,1-Trichloroethane		ND		ND	ND	ND	ND
1,1,2-Trichloroethane		ND		ND	ND	ND	ND
Trichloroethene		ND		ND	ND	ND	240.0
Vinyl Acetate		ND		ND	ND	ND	ND
Vinyl Chloride		ND		ND	ND	ND	ND
Total Xylenes		ND		ND	ND	ND	ND
Other:							
Dimethyldisulfide		120.0 J		ND	ND	ND	ND
Unknown (total)		ND		2000.0 J	32.0 J	ND	ND
Unknown Alkane		8.0 J		ND	1300.0 J	96.0 J	19.0 J
Unknown Acid		6.0 J		ND	ND	ND	ND
Unknown Cycloalkane		ND		190.0 J	ND	ND	ND
Unkown Alcohol		ND		170.0 J	ND	ND	ND

Table No. 3-4 (continued)

PARAMETERS	IB(M)10W 6/3/88 ** (ug/l)	IB(M)10WB 3/3/89 (ug/l)	IB(M)11S 6/3/88 ** (ug/kg)	IB(M)11SB 3/3/89 (ug/kg)	IB(M)12S 6/3/88 ft (ug/kg)	IB(M)13S 6/3/88 ft (ug/kg)	IB(M)14S 6/3/88 ft (ug/kg)
Semi-Volatiles:							
Acenaphthene	ND	NA	ND	NA	NA	NA	NA
Acenaphthylene	ND	NA	ND	NA	NA	NA	NA
Anthracene	ND	NA	ND	NA	NA	NA	NA
Benzo(a)anthracene	ND	NA	ND	NA	NA	NA	NA
Benzoic Acid	29.0 J	NA	ND	NA	NA	NA	NA
Benzyl Alcohol	ND	NA	ND	NA	NA	NA	NA
Benzo(b)fluoranthene	ND	NA	ND	NA	NA	NA	NA
Benzo(k)fluoranthene	ND	NA	ND	NA	NA	NA	NA
Benzo(g,h,i)perylene	ND	NA	ND	NA	NA	NA	NA
Benzo(a)pyrene	ND	NA	ND	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	ND	NA	ND	NA	NA	NA	NA
Butyl Benzyl Phthalate	ND	NA	ND	NA	NA	NA	NA
4-Chloroaniline	ND	NA	ND	NA	NA	NA	NA
bis (2-Chloroethoxy) methane	ND	NA	ND	NA	NA	NA	NA
bis (2-Chloroethyl) ether	ND	NA	ND	NA	NA	NA	NA
bis (2-Chloroisopropyl) ether	ND	NA	ND	NA	NA	NA	NA
4-Chloro-3-Methylphenol	ND	NA	ND	NA	NA	NA	NA
(p-chloro-m-cresol)	ND	NA	ND	NA	NA	NA	NA
2-Chloronaphthalene	ND	NA	ND	NA	NA	NA	NA
2-Chlorophenol	ND	NA	ND	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	ND	NA	ND	NA	NA	NA	NA
Chrysene	ND	NA	ND	NA	NA	NA	NA
Dibenz(a,h)anthracene	ND	NA	ND	NA	NA	NA	NA
Dibenzofuran	ND	NA	ND	NA	NA	NA	NA
Di-n-butylphthalate	ND	NA	ND	NA	NA	NA	NA
1,2-Dichlorobenzene	ND	NA	ND	NA	NA	NA	NA
1,3-Dichlorobenzene	ND	NA	ND	NA	NA	NA	NA
1,4-Dichlorobenzene	ND	NA	1060.0 J	NA	NA	NA	NA
3,3'-Dichlorobenzidine	ND	NA	ND	NA	NA	NA	NA
2,4-Dichlorophenol	ND	NA	ND	NA	NA	NA	NA
Diethylphthalate	ND	NA	ND	NA	NA	NA	NA
2,4-Dimethylphenol	ND	NA	ND	NA	NA	NA	NA
Dimethyl Phthalate	ND	NA	ND	NA	NA	NA	NA
4,6-Dinitro-2-Methyl Phenol	ND	NA	ND	NA	NA	NA	NA
2,4-Dinitrophenol	ND	NA	ND	NA	NA	NA	NA
2,4-Dinitrotoluene	ND	NA	ND	NA	NA	NA	NA
2,6-Dinitrotoluene	ND	NA	ND	NA	NA	NA	NA
Di-n-Octyl Phthalate	ND	NA	ND	NA	NA	NA	NA
bis (2-ethylhexyl) Phthalate	ND	NA	2000.0 B	NA	NA	NA	NA
Fluoranthene	ND	NA	ND	NA	NA	NA	NA
Fluorene	ND	NA	ND	NA	NA	NA	NA
Hexachlorobenzene	ND	NA	ND	NA	NA	NA	NA
Hexachlorobutadiene	ND	NA	ND	NA	NA	NA	NA
Hexachlorocyclopentadiene	ND	NA	ND	NA	NA	NA	NA
Hexachloroethane	ND	NA	ND	NA	NA	NA	NA

Table No. 3-4 (continued)

PARAMETERS	IB(M)10W 6/3/88 ** (ug/l)	IB(M)10WB 3/3/89 (ug/l)	IB(M)11S 6/3/88 ** (ug/kg)	IB(M)11SB 3/3/89 (ug/kg)	IB(M)12S 6/3/88 ft (ug/kg)	IB(M)13S 6/3/88 ft (ug/kg)	IB(M)14S 6/3/88 ft (ug/kg)
Indeno(1,2,3-cd)pyrene	ND	NA	ND	NA	NA	NA	NA
Isophorone	ND	NA	ND	NA	NA	NA	NA
2-Methylnaphthalene	ND	NA	ND	NA	NA	NA	NA
2-Methyl Phenol	ND	NA	ND	NA	NA	NA	NA
4-Methyl Phenol	58.0	NA	ND	NA	NA	NA	NA
Naphthalene	ND	NA	ND	NA	NA	NA	NA
2-Nitroaniline	ND	NA	ND	NA	NA	NA	NA
3-Nitroaniline	ND	NA	ND	NA	NA	NA	NA
4-Nitroaniline	ND	NA	ND	NA	NA	NA	NA
Nitrobenzene	ND	NA	ND	NA	NA	NA	NA
2-Nitrophenol	ND	NA	ND	NA	NA	NA	NA
4-Nitrophenol	ND	NA	ND	NA	NA	NA	NA
N-Nitroso-Diphenylamine	ND	NA	ND	NA	NA	NA	NA
N-Nitroso-Dipropylamine	ND	NA	ND	NA	NA	NA	NA
Pentachlorophenol	ND	NA	ND	NA	NA	NA	NA
Phenanthrene	ND	NA	ND	NA	NA	NA	NA
Phenol	ND	NA	ND	NA	NA	NA	NA
Phenol (total)	87.6	NA	700.0	NA	NA	NA	NA
Pyrene	ND	NA	ND	NA	NA	NA	NA
1,2,4-Trichlorobenzene	ND	NA	ND	NA	NA	NA	NA
2,4,5-Trichlorophenol	ND	NA	ND	NA	NA	NA	NA
2,4,6-Trichlorophenol	ND	NA	ND	NA	NA	NA	NA
Other:							
Benzeneocetic Acid	12.0 J	NA	ND	NA	NA	NA	NA
Hexadecanoic Acid	32.0 J	NA	ND	NA	NA	NA	NA
Phenol,4-Nonyl	ND	NA	11000 J	NA	NA	NA	NA
Sulfur, Mol.	11.0 J	NA	ND	NA	NA	NA	NA
Unknown (total)	114.0 J	NA	240000 J	NA	NA	NA	NA
Unknown Carboxylic Acid (total)	45.0 J	NA	ND	NA	NA	NA	NA
Unknown Cyclohexane	240.0 J	NA	ND	NA	NA	NA	NA
Unknown Phenols (total)	ND	NA	30000	NA	NA	NA	NA
Unknown Alkane (total)	ND	NA	15000 J	NA	NA	NA	NA
Unknown Alcohol	ND	NA	150000 J	NA	NA	NA	NA
Unknown Isomer of Chloestenone	ND	NA	13000 J	NA	NA	NA	NA

Table No. 3-4 (continued)

PARAMETERS	IB(M)10W 6/3/88 ** (ug/l)	IB(M)10WB 3/3/89 (ug/l)	IB(M)11S 6/3/88 ** (mg/kg)	IB(M)11SB 3/?/89 (mg/kg)	IB(M)12S 6/3/88 ft (mg/kg)	IB(M)13S 6/3/88 ft (mg/kg)	IB(M)14S 6/3/88 ft (mg/kg)
Inorganics:							
Aluminum	[150.0] P	NA	1600.0 P	NA	NA	NA	NA
Antimony	60.0 UPN	NA	23.1 UPN	NA	NA	NA	NA
Arsenic	3.0 UF	NA	[1.5] F	NA	NA	NA	NA
Barium	[66.0] P	NA	[40.0] P	NA	NA	NA	NA
Beryllium	0.5 UP	NA	0.2 UP	NA	NA	NA	NA
Cadmium	5.0 UP	NA	2.7 P	NA	NA	NA	NA
Calcium	116000.0P	NA	7000.0 P	NA	NA	NA	NA
Chromium	11.0 P	NA	12.0 P*	NA	NA	NA	NA
Cobalt	15.0 UP	NA	5.8 UP	NA	NA	NA	NA
Copper	30.0 P	NA	480.0 P	NA	NA	NA	NA
Cyanide	10.0 U	NA	2.4 U	NA	NA	NA	NA
Iron	1300.0 P	NA	10300.0 P	NA	NA	NA	NA
Lead	7.9 SFN*	NA	130.0 F1:10	NA	NA	NA	NA
Magnesium	29600.0 P	NA	[1700.0] P	NA	NA	NA	NA
Manganese	170.0 P	NA	51.0 P	NA	NA	NA	NA
Mercury	0.6 CV	NA	0.2 UCV	NA	NA	NA	NA
Nickel	15.0 UP	NA	5.8 UP	NA	NA	NA	NA
Potassium	56100.0 P	NA	500.0 UP	NA	NA	NA	NA
Selenium	2.0 UF	NA	0.8 UF	NA	NA	NA	NA
Silver	10.0 UP	NA	3.8 UP	NA	NA	NA	NA
Sodium	80000.0 P	NA	[290.0] P	NA	NA	NA	NA
Thallium	2.0 UFN	NA	0.8 UF	NA	NA	NA	NA
Vanadium	10.0 UP	NA	3.8 UP	NA	NA	NA	NA
Zinc	1000.0 PE	NA	2300.0 P	NA	NA	NA	NA

Table No. 3-4 (continued)

PARAMETERS	IB(M)10W 6/3/88 +# (ug/l)	IB(M)10WB 3/3/89 (ug/l)	IB(M)11S 6/3/88 +# (ug/kg)	IB(M)11SB 3/3/89 (ug/kg)	IB(M)12S 6/3/88 ft (ug/kg)	IB(M)13S 6/3/88 ft (ug/kg)	IB(M)14S 6/3/88 ft (ug/kg)
Pesticides/PCBs:							
Aldrin		ND		ND	NA	NA	NA
AROCLOR-1016		ND		ND	NA	NA	NA
AROCLOR-1221		ND		ND	NA	NA	NA
AROCLOR-1232		ND		ND	NA	NA	NA
AROCLOR-1242		ND		ND	NA	NA	NA
AROCLOR-1248		ND		ND	NA	NA	NA
AROCLOR-1254		ND		ND	NA	NA	NA
AROCLOR-1260		ND		ND	NA	NA	NA
alpha-BHC		ND		ND	NA	NA	NA
beta-BHC		ND		ND	NA	NA	NA
delta-BHC		ND		ND	NA	NA	NA
gamma-BHC (Lindane)		ND		ND	NA	NA	NA
alpha-Chlordane		ND		ND	NA	NA	NA
gamma-Chlordane		ND		ND	NA	NA	NA
4,4'-DDD		ND		ND	NA	NA	NA
4,4'-DDE		ND		ND	NA	NA	NA
4,4'-DDT		ND		ND	NA	NA	NA
Dieldrin		ND		ND	NA	NA	NA
Endrin		ND		ND	NA	NA	NA
Endrin Ketone		ND		ND	NA	NA	NA
Endosulfan I		ND		ND	NA	NA	NA
Endosulfan II		ND		ND	NA	NA	NA
Endosulfan Sulfate		ND		ND	NA	NA	NA
Heptachlor		0.16		ND	NA	NA	NA
Heptachlor Epoxide		ND		ND	NA	NA	NA
Methoxychlor		ND		ND	NA	NA	NA
Toxaphene		ND		ND	NA	NA	NA

U - Indicates compound was analyzed for but not detected.
Reported with the instrument detection limits
N - Indicates spike sample recovery is not within control limits.
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
* - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range on two of the evaluation standard runs.
# - Duplicate analysis is not within control limits
CV - Cold vapor analysis
F - Indicates furnace analysis
P - Indicates ICP analysis
S - Value determined by standard addition
E - Estimated or not reported due to interference
Lead for sample 11S was analyzed at a 1:10 dilution
D - Indicates sample was diluted.
NA - Not analyzed
ND - Not detected
blank space - Data is invalid

Table No. 3-4 (continued)

PARAMETERS	Trip Blank 6/1/88 + (ug/l)	Field Blank 6/1/88 + (ug/l)	Field Blank 6/2/88 (ug/l)	Trip Blank 6/2/88 (ug/l)	Trip Blank 6/3/88 (ug/l)	Field Blank 6/3/88 * (ug/l)	Trip Blank 3/3/89 (ug/l)	Field Blank 3/3/89 (ug/l)
Volatiles:								
Acetone			57.1 B	70.0 B	13.0 J	12.0 J	ND	ND
Benzene			ND	ND	ND	ND	ND	ND
Bromodichloromethane			ND	ND	ND	ND	ND	ND
Bromoform			ND	ND	ND	ND	ND	ND
Bromomethane			ND	ND	ND	ND	ND	ND
2-Butanone			ND	ND	ND	ND	ND	ND
Chlorobenzene			ND	ND	ND	ND	ND	ND
Carbon Disulfide			ND	ND	ND	ND	ND	ND
Carbon Tetrachloride			ND	ND	ND	ND	ND	ND
Chloroethane			ND	ND	ND	ND	ND	ND
Chloroform			ND	ND	ND	ND	ND	ND
Chloromethane			ND	ND	ND	ND	ND	ND
Dibromochloromethane			ND	ND	ND	ND	ND	ND
1,1-Dichloroethane			ND	ND	ND	ND	ND	ND
1,2-Dichloroethane			ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene			ND	ND	ND	ND	ND	ND
1,2-Dichloroethylene			ND	ND	ND	ND	ND	ND
1,2-Dichloropropane			ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene			ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene			ND	ND	ND	ND	ND	ND
Ethyl Benzene			ND	ND	ND	ND	ND	ND
2-Hexanone			ND	ND	ND	ND	ND	ND
Methylene Chloride			9.7 B	6.5 B	26.0 J	23.0 J	3.0 J	ND
4-Methyl-2-Pentanone			ND	ND	ND	ND	ND	ND
Styrene			ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane			ND	ND	ND	ND	ND	ND
Tetrachloroethylene			ND	ND	ND	ND	ND	ND
Toluene			ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane			ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane			ND	ND	ND	ND	ND	ND
Trichloroethene			ND	ND	ND	ND	ND	ND
Vinyl Acetate			ND	ND	ND	ND	ND	ND
Vinyl Chloride			ND	ND	ND	ND	ND	ND
Total Xylenes			ND	ND	ND	ND	ND	ND
Other:								
Unknown Alkane			12.0 J	ND	ND	ND	ND	ND

Table No. 3-4 (continued)

PARAMETERS	Trip Blank 6/1/88 + (ug/l)	Field Blank 6/1/88 + (ug/l)	Field Blank 6/2/88 (ug/l)	Trip Blank 6/2/88 (ug/l)	Trip Blank 6/3/88 (ug/l)	Field Blank 6/3/88 + (ug/l)	Trip Blank 3/3/89 (ug/l)	Field Blank 3/3/89 (ug/l)
Semi-Volatiles:								
Acenaphthene	NA	ND	ND	NA	NA	ND	NA	NA
Acenaphthylene	NA	ND	ND	NA	NA	ND	NA	NA
Anthracene	NA	ND	ND	NA	NA	ND	NA	NA
Benzo(a)anthracene	NA	ND	ND	NA	NA	ND	NA	NA
Benzoic Acid	NA	ND	ND	NA	NA	ND	NA	NA
Benzyl Alcohol	NA	ND	ND	NA	NA	ND	NA	NA
Benzo(b)fluoranthene	NA	ND	ND	NA	NA	ND	NA	NA
Benzo(k)fluoranthene	NA	ND	ND	NA	NA	ND	NA	NA
Benzo(g,h,i)perylene	NA	ND	ND	NA	NA	ND	NA	NA
Benzo(a)pyrene	NA	ND	ND	NA	NA	ND	NA	NA
4-Bromophenyl Phenyl Ether	NA	ND	ND	NA	NA	ND	NA	NA
Butyl Benzyl Phthalate	NA	ND	ND	NA	NA	ND	NA	NA
4-Chloroaniline	NA	ND	ND	NA	NA	ND	NA	NA
bis (2-Chloroethoxy) methane	NA	ND	ND	NA	NA	ND	NA	NA
bis (2-Chloroethyl) ether	NA	ND	ND	NA	NA	ND	NA	NA
bis (2-Chloroisopropyl) ether	NA	ND	ND	NA	NA	ND	NA	NA
4-Chloro-3-Methylphenol (p-chloro-m-cresol)	NA	ND	ND	NA	NA	ND	NA	NA
2-Chloronaphthalene	NA	ND	ND	NA	NA	ND	NA	NA
2-Chlorophenol	NA	ND	ND	NA	NA	ND	NA	NA
4-Chlorophenyl Phenyl Ether	NA	ND	ND	NA	NA	ND	NA	NA
Chrysene	NA	ND	ND	NA	NA	ND	NA	NA
Dibenz(a,h)anthracene	NA	ND	ND	NA	NA	ND	NA	NA
Dibenzofuran	NA	ND	ND	NA	NA	ND	NA	NA
Di-n-butylphthalate	NA	13.0	ND	NA	NA	ND	NA	NA
1,2-Dichlorobenzene	NA	ND	ND	NA	NA	ND	NA	NA
1,3-Dichlorobenzene	NA	ND	ND	NA	NA	ND	NA	NA
1,4-Dichlorobenzene	NA	ND	ND	NA	NA	ND	NA	NA
3,3'-Dichlorobenzidine	NA	ND	ND	NA	NA	ND	NA	NA
2,4-Dichlorophenol	NA	ND	ND	NA	NA	ND	NA	NA
Diethylphthalate	NA	ND	ND	NA	NA	ND	NA	NA
2,4-Dimethylphenol	NA	ND	ND	NA	NA	ND	NA	NA
Dimethyl Phthalate	NA	ND	ND	NA	NA	ND	NA	NA
4,6-Dinitro-2-Methyl Phenol	NA	ND	ND	NA	NA	ND	NA	NA
2,4-Dinitrophenol	NA	ND	ND	NA	NA	ND	NA	NA
2,4-Dinitrotoluene	NA	ND	ND	NA	NA	ND	NA	NA
2,6-Dinitrotoluene	NA	ND	ND	NA	NA	ND	NA	NA
Di-n-Octyl Phthalate	NA	ND	ND	NA	NA	ND	NA	NA
bis (2-ethylhexyl) Phthalate	NA	ND	ND	NA	NA	190.0 B	NA	NA
Fluoranthene	NA	ND	ND	NA	NA	ND	NA	NA
Fluorene	NA	ND	ND	NA	NA	ND	NA	NA
Hexachlorobenzene	NA	ND	ND	NA	NA	ND	NA	NA
Hexachlorobutadiene	NA	ND	ND	NA	NA	ND	NA	NA
Hexachlorocyclopentadiene	NA	ND	ND	NA	NA	ND	NA	NA
Hexachloroethane	NA	ND	ND	NA	NA	ND	NA	NA

Table No. 3-4 (continued)

PARAMETERS	Trip Blank 6/1/88 + (ug/l)	Field Blank 6/1/88 + (ug/l)	Field Blank 6/2/88 (ug/l)	Trip Blank 6/2/88 (ug/l)	Trip Blank 6/3/88 (ug/l)	Field Blank 6/3/88 * (ug/l)	Trip Blank 3/3/89 (ug/l)	Field Blank 3/3/89 (ug/l)
Indeno(1,2,3-cd)pyrene	NA	ND	ND	NA	NA	ND	NA	NA
Isophorone	NA	ND	ND	NA	NA	ND	NA	NA
2-Methylnaphthalene	NA	ND	ND	NA	NA	ND	NA	NA
2-Methyl Phenol	NA	ND	ND	NA	NA	ND	NA	NA
4-Methyl Phenol	NA	ND	ND	NA	NA	ND	NA	NA
Naphthalene	NA	ND	ND	NA	NA	ND	NA	NA
2-Nitroaniline	NA	ND	ND	NA	NA	ND	NA	NA
3-Nitroaniline	NA	ND	ND	NA	NA	ND	NA	NA
4-Nitroaniline	NA	ND	ND	NA	NA	ND	NA	NA
Nitrobenzene	NA	ND	ND	NA	NA	ND	NA	NA
2-Nitrophenol	NA	ND	ND	NA	NA	ND	NA	NA
4-Nitrophenol	NA	ND	ND	NA	NA	ND	NA	NA
N-Nitroso-Diphenylamine	NA	ND	ND	NA	NA	ND	NA	NA
N-Nitroso-Dipropylamine	NA	ND	ND	NA	NA	ND	NA	NA
Pentachlorophenol	NA	ND	ND	NA	NA	ND	NA	NA
Phenanthrene	NA	ND	ND	NA	NA	ND	NA	NA
Phenol	NA	ND	ND	NA	NA	ND	NA	NA
Phenol (total)	NA	ND	ND	NA	NA	ND	NA	NA
Pyrene	NA	ND	ND	NA	NA	ND	NA	NA
1,2,4-Trichlorobenzene	NA	ND	ND	NA	NA	ND	NA	NA
2,4,5-Trichlorophenol	NA	ND	ND	NA	NA	ND	NA	NA
2,4,6-Trichlorophenol	NA	ND	ND	NA	NA	ND	NA	NA
Other:								
Hexadecanoic Acid	NA	ND	ND	NA	NA	240.0 J	NA	NA
Unknown (total)	NA	ND	ND	NA	NA	110.0 J	NA	NA
Unknown Hydrocarbon	NA	ND	ND	NA	NA	150.0 J	NA	NA

Table No. 3-4 (continued)

PARAMETERS	Trip Blank 6/1/88 + (ug/l)	Field Blank 6/1/88 + (ug/l)	Field Blank 6/2/88 (ug/l)	Trip Blank 6/2/88 (ug/l)	Trip Blank 6/3/88 (ug/l)	Field Blank 6/3/88 * (ug/l)	Trip Blank 3/3/89 (ug/l)	Field Blank 3/3/89 (ug/l)
Inorganics:								
Aluminum	NA	ND	ND	NA	NA	ND	NA	NA
Antimony	NA	ND	ND	NA	NA	ND	NA	NA
Arsenic	NA	ND	ND	NA	NA	ND	NA	NA
Barium	NA	ND	ND	NA	NA	ND	NA	NA
Beryllium	NA	ND	ND	NA	NA	ND	NA	NA
Cadmium	NA	ND	ND	NA	NA	ND	NA	NA
Calcium	NA	ND	ND	NA	NA	ND	NA	NA
Chromium	NA	ND	ND	NA	NA	ND	NA	NA
Cobalt	NA	ND	ND	NA	NA	ND	NA	NA
Copper	NA	ND	ND	NA	NA	ND	NA	NA
Cyanide	NA	ND	ND	NA	NA	ND	NA	NA
Iron	NA	ND	ND	NA	NA	ND	NA	NA
Lead	NA	ND	ND	NA	NA	ND	NA	NA
Magnesium	NA	ND	ND	NA	NA	ND	NA	NA
Manganese	NA	ND	ND	NA	NA	ND	NA	NA
Mercury	NA	ND	ND	NA	NA	ND	NA	NA
Nickel	NA	ND	ND	NA	NA	ND	NA	NA
Potassium	NA	ND	ND	NA	NA	ND	NA	NA
Selenium	NA	ND	ND	NA	NA	ND	NA	NA
Silver	NA	ND	ND	NA	NA	ND	NA	NA
Sodium	NA	ND	ND	NA	NA	ND	NA	NA
Thallium	NA	ND	ND	NA	NA	ND	NA	NA
Vanadium	NA	ND	ND	NA	NA	ND	NA	NA
Zinc	NA	ND	ND	NA	NA	ND	NA	NA

Table No. 3-4 (continued)

PARAMETERS	Trip Blank 6/1/88 ‡ (ug/l)	Field Blank 6/1/88 + (ug/l)	Field Blank 6/2/88 (ug/l)	Trip Blank 6/2/88 (ug/l)	Trip Blank 6/3/88 (ug/l)	Field Blank 6/3/88 ‡ (ug/l)	Trip Blank 3/3/89 (ug/l)	Field Blank 3/3/89 (ug/l)
Pesticides/PCBs:								
Aldrin	NA	ND	ND	NA	NA		NA	ND
AROCLOR-1016	NA	ND	ND	NA	NA		NA	ND
AROCLOR-1221	NA	ND	ND	NA	NA		NA	ND
AROCLOR-1232	NA	ND	ND	NA	NA		NA	ND
AROCLOR-1242	NA	ND	ND	NA	NA		NA	ND
AROCLOR-1248	NA	ND	ND	NA	NA		NA	ND
AROCLOR-1254	NA	ND	ND	NA	NA		NA	ND
AROCLOR-1260	NA	ND	ND	NA	NA		NA	ND
alpha-BHC	NA	ND	ND	NA	NA		NA	ND
beta-BHC	NA	ND	ND	NA	NA		NA	ND
delta-BHC	NA	ND	ND	NA	NA		NA	ND
gamma-BHC (Lindane)	NA	ND	ND	NA	NA		NA	ND
alpha-Chlordane	NA	ND	ND	NA	NA		NA	ND
gamma-Chlordane	NA	ND	ND	NA	NA		NA	ND
4,4'-DDD	NA	ND	ND	NA	NA		NA	ND
4,4'-DDE	NA	ND	ND	NA	NA		NA	ND
4,4'-DDT	NA	ND	ND	NA	NA		NA	ND
Dieldrin	NA	ND	ND	NA	NA		NA	ND
Endrin	NA	ND	ND	NA	NA		NA	ND
Endrin ketone	NA	ND	ND	NA	NA		NA	ND
Endosulfan I	NA	ND	ND	NA	NA		NA	ND
Endosulfan II	NA	ND	ND	NA	NA		NA	ND
Endosulfan Sulfate	NA	ND	ND	NA	NA		NA	ND
Heptachlor	NA	ND	ND	NA	NA		NA	ND
Heptachlor Epoxide	NA	ND	ND	NA	NA		NA	ND
Methoxychlor	NA	ND	ND	NA	NA		NA	ND
Toxaphene	NA	ND	ND	NA	NA		NA	ND

J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
‡ - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range on two of the evaluation standard runs.
S - Surrogate spike
+ - Holding time exceeded for volatiles
++ - Holding time for field/trip blanks exceeded for volatiles
NA - Not analyzed
ND - Not detected
blank space - Data is invalid

- o The symbol "ND" indicates that the analysis of this compound met the NYSDEC CLP QA/QC requirements, but was not measured above the analytical instrument's detection limits (IDL).

- o The symbol "NA" indicates that the compound was not analyzed.

Qualifiers that accompany the concentrations reported in the table are the NYSDEC CLP concentration qualifiers.

In addition, several sample results show the presence of unknown isomers and "other" compounds. These compounds are listed in the table and presented in the text, however, identification and determination of the exact levels of the compounds, as well as a discussion of their presence and extent of contamination is not definable within the context of this program and will be excluded from discussions. In order to more clearly identify and define possible contamination by these compounds, additional sampling would be necessary with the primary focus of analysis based on these parameters.

Also similar to the presentation of the results for Phase IA, a number of the environmental samples have letter subscripts following the numerical concentration values. A letter 'B' indicates the analyte was found in the laboratory method blank samples as well as the environmental sample. The letter 'J' indicates that the concentration is an estimated value.

3.4.1 Potential Source Investigation (Septic Tanks)

As was noted in Sections 3.2.2 and 3.2.4, 2-butanone (methyl ethyl ketone [MEK]) was detected in the sediment samples collected from the drainage system catch basin and stream bed along Lake Avenue, as well as the downstream sediment samples in Turtle Pond and at the confluence of the outlet of Turtle Pond and the Mianus River. The fact that MEK was detected downstream of Route 22, but not on the Mall property, suggests a possible source of this contaminant other than the Mall property. Provision was made to obtain two samples (one sludge and one supernatant) from the subsurface disposal system at the hardware store located immediately northeast of the intersection of Lake Avenue and Route 22 and upgradient of the stream/pond drainage system.

3.4.1.1 Organic Sampling Results

The supernatant (liquid) sample IB(M)10W obtained from the hardware store septic tank contained the following organic compounds and the organochlorine pesticide, heptachlor. None of the organic compounds were the analytes of concern: (Please note that the initial sample failed QA/QC requirements for volatiles and pesticides/PCBs. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Dimethyl disulfide	120.0 J
4-Methyl phenol	58.0
Benzoic acid	29.0 J
Benzeneocetic acid	12.0 J
Hexadecanoic acid	32.0 J
Sulfur, mol.	11.0 J
Phenol (total)	87.6
Unknown alkane	8.0 J
Unknown acid	6.0 J
Unknown (total)	114.0 J
Unknown carboxylic acid (total)	45.0 J
Unknown cyclohexane	240.0 J
Heptachlor	0.16

"J" indicates estimated value.
"B" indicates compound found in method blank.

The sample IB(M)11S collected from the hardware store septic tank sludge contained the following organic compounds, again, none of which were analytes of concern: (Please note that the initial sample failed QA/QC requirements for volatiles and pesticides/PCBs. Therefore, this location was resampled and reanalyzed and only these valid analyticial results are presented.)

Compound	Concentration (ug/kg)
Acetone	3,100.0 D
Bis(2-ethylhexl)phthalate	2,000.0 B
1,4-Dichlorobenzene	1,060.0 J
Phenol, 4-nonyl	11,000.0 J
Phenol (total)	700.0
Unknown (total)	242,000.0 J
Unknown cycloalkane	190.0 J
Unknown alcohol	150,170.0 J
Unknown phenols (total)	30,000.0
Unknown alkane (total)	15,000.0 J
Unknown isomer of choestenone	13,000.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.
"D" indicates sample was diluted.

No pesticides or PCBs were detected in sample IB(M)11SB. However, it should be noted that sample IB(M)11SB was diluted prior to pesticide/PCB analysis by a factor of four. The laboratory diluted this sample based upon the dark color of the extract. In addition, this sample was chosen to be spiked and run as a MS/MSD set. However, the analysis of the sample extract resulted in instrument difficulties and another MS/MSD was substituted.

Although the pesticide/PCB analysis did not meet QA/QC requirements, the sample results for IB(M)11SB should be considered valid because past sample analyses throughout the Hunting Ridge Mall study area have shown that pesticide/PCB compounds have not been detected in the area except in only one sample (IB [M] 10W) where a low level (0.16 ug/l) of only one pesticide (heptachor) was found.

3.4.1.2 Inorganic Sampling Results

The liquid sample IB(M)10W contained the following inorganic constituents:

Constituent	Concentration (ug/l)
Aluminum	[150.0]
Barium	[66.0]
Calcium	116,000.0
Chromium	11.0
Copper	30.0
Iron	1,300.0
Magnesium	29,600.0
Manganese	170.0
Mercury	0.6
Potassium	56,100.0
Sodium	80,000.0
Zinc	1,000.0 E

"E" indicates this sample value was estimated due to interference.
"[ ]" indicates the reported value is between the CRDL and IDL.

The sludge sample IB(M)11S contained the following inorganic constituents:

Constituent	Concentration (mg/kg)
Aluminum	1,600.0
Arsenic	[1.5]
Barium	[40.0]
Cadmium	2.7
Calcium	7,000.0
Chromium	12.0 #
Copper	480.0

Iron	10,300.0
Lead	130.0
Magnesium	[1,700.0]
Manganese	51.0
Sodium	[290.0]
Zinc	2,300.0

"#" indicates duplicate analysis was not within control limits.
"[ ]" indicates the reported value is between the CRDL and IDL.

3.4.2 Stormwater Drainage System Sediment Investigation

The Phase IA sampling program confirmed the existence of low level concentrations of contaminants in each of the stormwater drainage system sediment samples collected. Additional samples were collected in the drainage system during Phase IB to determine the extent of the contamination in the drainage system. Provision was made to sample two catch basins in the Mall parking lot, along with one catch basin on Route 22 adjacent to the Shorco Gas Station.

3.4.2.1 Organic Sampling Results

Sediment sample IB(M)01S was collected from the catch basin east of the Mall building. This sample contained the following organic compounds, none of which were analytes of concern:

Compound	Concentration (ug/kg)
Methylene chloride	9.0 B
Acetone	39.0 B

"B" indicates compound found in method blank.

Sediment sample IB(M)02S was collected from the catch basin on the west side of the Mall building and contained the following organic compounds, none of which were analytes of concern:

Compound	Concentration (ug/kg)
Methylene chloride	8.0 B
Acetone	44.0 B
Unknown (total)	5.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample IB(M)03S was collected from the catch basin adjacent to the Shorco Gas Station on Route 22. IB(M)03S contained the following organic compounds:

Analytes of Concern	Concentration (ug/kg)
Tetrachloroethene	5.0

Other Compounds	Concentration (ug/kg)
Methylene chloride	7.0 B
Acetone	9.0 B

"B" indicates compound found in method blank.

The stormwater drainage system discharges into the ephemeral stream bed that runs parallel with Lake Avenue. Six sediment samples were collected in the stream bed to reconfirm the analytical results of the sediment sample collected during Phase IA and to determine the effectiveness of the soil removal corrective action undertaken in 1983.

Sediment sample IB(M)04S was obtained from a depth of six inches in the middle of the streambed and eight feet downgradient from the stormwater discharge pipe. IB(M) 04S contained the following organic compounds:

Compound	Concentration (ug/kg)
Methylene chloride	11.0 B
Acetone	93.0 B
2-Butanone	5.8 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample IB(M)05S was obtained from a depth of 24 inches, 1 foot east of midstream and 8 feet downgradient of the stormwater discharge pipe. This sample contained the following organic compounds:

Compound	Concentration (ug/kg)
Methylene chloride	11.0 B
Acetone	66.0 B
2-Butanone	3.0 J
Unknown (total)	473.0 J
Unknown alkene (total)	231.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample IB(M)06S was obtained from a depth of 6 inches in the middle of the stream bed and approximately 100 feet downgradient of the stormwater discharge pipe. IB(M)06S contained the following organic compounds:

Compound	Concentration (ug/kg)
Methylene chloride	5.7 B
Acetone	32.0 B

"B" indicates compound found in method blank.

Sediment sample IB(M)07S was obtained from a depth of 24 inches along the west bank of the streambed approximately 100 feet downgradient of the stormwater discharge pipe and contained the following organic compounds:

Compound	Concentration (ug/kg)
Methylene chloride	6.2 B
Acetone	66.0 B
Unknown alkane (total)	15.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample IB(M)08S was obtained from a depth of 6 inches in the center of the streambed approximately 150 feet downgradient of the stormwater discharge pipe. IB(M)08S contained the following organic compounds:

Analytes of Concern	Concentration (ug/kg)
Benzene	1.0 J

Other Compounds	Concentration (ug/kg)
Methylene chloride	9.0 B
Acetone	35.0 B
Chlorobenzene	8.0
Unknown alkane (total)	150.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample IB(M)09S was obtained from a depth of 24 inches in the center of the streambed approximately 150 feet downgradient of the stormwater drainage discharge pipe. This sample contained the following organic compounds:

Compound	Concentration (ug/kg)
Methylene chloride	860.0 B
Acetone	5,500.0 B
1,1,2-Trichloro-1,2,2-trifluoroethane	2,500.0 JB
Unknown (total)	3,500.0 J
Unknown alkane (total)	4,000.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

3.4.3 Surface Water Investigation (Stream/Pond Confluence with the Mianus River)

Since there existed a problem with the quality ontrol exercised by the laboratory in analyzing the Phase IA samples of the surface water [IA(M)07W] and the sediment [IA(M)07S] discharging from the Hunting Ridge Mall drainage system into the Mianus River, provision was included in the Phase IB sampling program to re-sample this location. (See Sections 3.2.3 and 3.2.4 for the resampling analytical results for surface water sample IA(M)07WA and sediment sample IA(M)07SA.

3.4.4 Surface Water Sediment Investigation (Ponds)

As part of the Phase IA investigation, a sediment sample collected from Turtle Pond indicated the presence of volatile organic contamination. Provision was included in the Phase IB program to re-sample the sediment in Turtle Pond as well as the two additional ponds downgradient of Turtle Pond before discharge into the Mianus River.

3.4.4.1 Organic Sampling Results

Sediment sample IB(M)14S was collected at a depth of nine inches at the head of Turtle Pond (where the Lake Avenue stream bed enters into Turtle Pond). IB(M)14S contained the following organic compounds:

Analytes of Concern	Concentration (ug/kg)
Tetrachloroethene	600.0
Trichloroethene	240.0
Trans-1,2-dichloroethene	31.0

Other Compounds	Concentration (ug/kg)
Methylene chloride	68.0 B
Acetone	430.0 B
Carbon disulfide	7.0
2-Butanone	34.0 J
Unknown alkane	19.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample IB(M)13S was collected at a depth of six inches at the head of the pond directly downstream of Turtle Pond and contained the following organic compounds:

Compound	Concentration (ug/kg)
Methylene chloride	10.0 B
Acetone	130.0 B
Carbon disulfide	13.0
2-Butanone	20.0
Unknown alkane	96.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Sediment sample IB(M)12S was collected at a depth of one foot at the head of the second pond located downstream of Turtle Pond. This sample contained the following organic compounds:

Compound	Concentration (ug/kg)
Methylene chloride	15.0 B
Acetone	91.0 B
2-Butanone	18.0 J
2-Hexanone	83.0
4-Methyl-2-pentanone	200.0
Unknown (total)	32.0 J
Unknown alkane	1,300.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

Section 4

4.0 HYDROGEOLOGIC INVESTIGATION

4.1 Field Investigation Methods and Results

4.1.1 Surface Geophysical Studies

4.1.1.1 Seismic Refraction

A comprehensive seismic geophysical survey was performed as part of the Hunting Ridge Mall Site Remedial Investigation. The purpose of this geophysical survey was to obtain non-destructive subsurface data which defined on a preliminary basis the depth to ground water and bedrock throughout the study area. Geophysical surveys are a cost-effective method that allows the profiling of large areas of the subsurface so that hydrogeologic maps can be constructed while minimizing the need for soil borings.

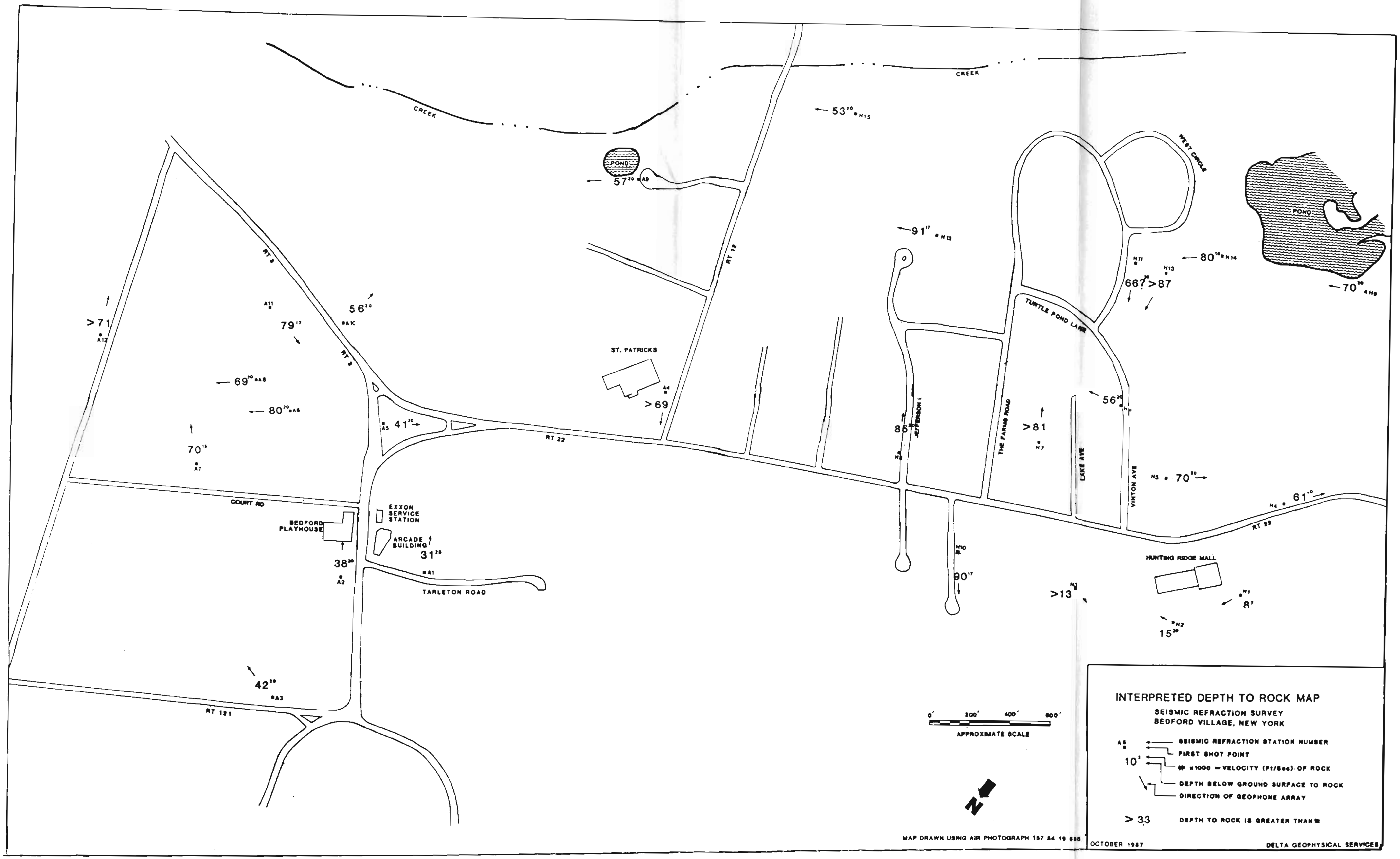
The seismic refraction method was utilized to generate the data. This method records a shock wave that is propagated by striking a sledge hammer against a plate laid on the ground surface. As the shock wave travels through the subsurface, it is affected by the densities of the material through which it passes. The resultant reflected wave is recorded along a line of geophones (sensing devices) which are placed on the ground surface at pre-selected distances from the wave source.

The refraction method utilizes the amount of time it takes the resultant wave to travel to each geophone. Analysis of the data (travel time and distance) provides velocities of the seismic wave in the subsurface. Depths to interfaces of differing seismic wave velocities can be computed from the data. Data was collected at 15 locations throughout the Hunting Ridge Mall Study Area.

The interpretation of the seismic data is presented on two maps, Figure Nos. 4-1 and 4-2, and in a table of results, Table No. 4-1. Figure No. 4-1 graphically depicts the seismic station location and number, depth to ground water (below ground surface) and the velocity of the water bearing layer. The velocity of the seismic wave is indicated by a number (smaller size) above the depth value. By multiplying this number by 1,000, the actual velocity can be determined.


INTERPRETED DEPTH TO WATER MAP
SEISMIC REFRACTION SURVEY
BEDFORD VILLAGE, NEW YORK
SEISMIC REFRACTION STATION NUMBER
FIRST SHOT POINT
x 1000 = VELOCITY (Ft/Sec) OF WATER BEARING LAYER
DEPTH BELOW GROUND SURFACE TO WATER
DIRECTION OF GEOPHONE ARRAY
> 33
DEPTH TO WATER IS GREATER THAN
OCTOBER 1987
DELTA GEOPHYSICAL SERVICES
MAP DRAWN USING AIR PHOTOGRAPH
APPROXIMATE SCALE
0'
200'
400'
600'
N
CREEK
POND
WEST CIRCLE
TURTLE POND LANE
JEFFERSON LANE
THE FARMS ROAD
LAKE AVE
VINTON AVE
HUNTING RIDGE MALL
RT 22
RT 12
RT 8
RT 121
ST PATRICKS
COURT RD
BEDFORD PLAYHOUSE
EXXON SERVICE STATION
ARCADE BUILDING
TARLETON ROAD

FIGURE NO. 4-1



INTERPRETED DEPTH TO ROCK MAP
SEISMIC REFRACTION SURVEY
BEDFORD VILLAGE, NEW YORK
SEISMIC REFRACTION STATION NUMBER
FIRST SHOT POINT
x1000 = VELOCITY (Ft/Sec) OF ROCK
DEPTH BELOW GROUND SURFACE TO ROCK
DIRECTION OF GEOPHONE ARRAY
> 33
DEPTH TO ROCK IS GREATER THAN
APPROXIMATE SCALE
0'
200'
400'
600'
N
MAP DRAWN USING AIR PHOTOGRAPH 157 84 19 586
OCTOBER 1987
DELTA GEOPHYSICAL SERVICES
CREEK
POND
ST. PATRICKS
RT 12
RT 22
RT 9
RT 121
COURT RD
TARLETON ROAD
BEDFORD PLAYHOUSE
EXXON SERVICE STATION
ARCADE BUILDING
JEFFERSON L
THE FARMS ROAD
TURTLE POND LANE
CAKE AVE
VINTON AVE
WEST CIRCLE
HUNTING RIDGE MALL

FIGURE NO. 4-2

Table No. 4–1

SEISMIC REFRACTION INTERPRETATION
HUNTING RIDGE MALL STUDY AREA

Station Number	Depth (Ft)	Velocity (Ft/Sec)	Interpreted Material
H1	0 to 8	1,150	TILL
	Below 8	7,000	WEATHERED ROCK
H2	0 to 5	1,100	TILL
	5 to 15	3,100	MOIST TILL
	Below 15	20,000	ROCK
H3	0 to 9	1,100	TILL
	9 to 61	3,000	MOIST TILL
	Below 61	20,000	ROCK
H4	0 to 9	1,100	TILL
	9 to 70	2,100	MOIST TILL
	Below 70	20,000	ROCK
H5	0 to 12	1,150	TILL
	12 to 70	2,100	MOIST TILL
	Below 70	20,000	ROCK
H6	0 to 16	900	TILL
	16 to 56	5,000	MOIST TILL
	Below 56	20,000	ROCK
H7	0 to 8	1,050	TILL
	8 to *	4,250	MOIST TILL
	* Depth to rock is greater than 81 feet		
H8	0 to 20	1,150	TILL
	20 to 85	4,750	MOIST TILL
	Below 85	20,000	ROCK
H9	0 to 16	1,200	TILL
	16 to 70	6,000	MOIST TILL
	Below 70	20,000	ROCK
H10	0 to 23	1,200	TILL
	23 to 90	5,050	MOIST TILL
	Below 90	17,000	ROCK
H11	0 to 12	800	TILL
	12 to 56	4,000	MOIST TILL
	Below 56	20,000	ROCK

Table No. 4–1 (continued)

SEISMIC REFRACTION INTERPRETATION
HUNTING RIDGE MALL STUDY AREA

Station Number	Depth (Ft)	Velocity (Ft/Sec)	Interpreted Material
H12	0 to 4	1,225	TILL
	4 to 90	4,500	MOIST TILL
	Below 91	17,000	ROCK
H13	0 to 26	1,200	TILL
	26 to *	5,900	MOIST TILL
	* Depth to rock is greater than 87 feet		
H14	0 to 18	1,100	TILL
	18 to 80	4,500	MOIST TILL
	Below 80	15,000	ROCK
H15	0 to 10	1,150	TILL
	10 to 53	4,250	MOIST TILL
	Below 53	20,000	ROCK

Figure No. 4-2 illustrates the seismic location and number, depth below ground surface to rock and the velocity of the rock. Again, the displayed velocity value can be multiplied by 1,000 to determine the actual velocity.

It should be noted that the data collected at seismic station H11 may be suspect due to the presence of a nearby leaching pool. The seismic station at H13 was located away from man-made structures and interference, and may be a better indication of the subsurface conditions in the area of H11. For a complete review of the geophysical survey report for the Hunting Ridge Mall Site, see Appendix C.

A comparison of depths to bedrock obtained using seismic refraction and actual depths to bedrock obtained from monitoring well borings reveals the seismic data to be relatively accurate in cases where boring locations coincided with seismic refraction data points. The one exception to this is the case of the area immediately to the south and east of the Mall where correlation was poor. This can be explained however, by the fact that the bedrock surface is steeply sloping to the south in this area (see Figure 4-13) resulting in substantial drops in bedrock surface elevation with horizontal distance.

Depths to groundwater obtained using seismic refraction were also compared to actual groundwater levels obtained from monitoring wells. Correlation was good for locations where groundwater depths were less than 20 feet below ground surface. For cases where groundwater was greater than 20 feet below ground surface, correlation was poor, as shown in the area of the Ponds Development opposite the Mall where discrepancies of 20 feet are observed.

4.1.1.2 Terrain Conductivity

A limited terrain conductivity survey was undertaken on the Hunting Ridge Mall property. During the construction of monitoring well MW-3M, an abandoned underground tank was encountered. To determine the dimensional location of the tank in order to place the well, this conductivity survey was performed.

Profiling was undertaken using a Geonics EM 31-DC conductivity meter which provides measurement of both the quadrature-phase and in-phase components of terrain conductivity without ground electrodes or contact. The nominal depth of subsurface sampled by this equipment is about 18 feet. The survey was conducted with continuous operation of the instrument. As a result of using this geophysical technique, MW-3M was successfully installed.

4.1.2 Soil Boring and Monitoring Well Installation

4.1.2.1 General Description

Section 1.5 of this document includes a description of the hydrogeologic investigation portion of the Bedford Village Wells-Hunting Ridge Mall Site as a multi-phased program comprised of Phases IIA and IIB. This program had been developed to supplement existing data and to provide a comprehensive site investigation which would characterize the hydrogeologic regime underlying the site. A further objective was to identify the source(s) of ground water contamination and to define the lateral and vertical extent of contaminated ground water to facilitate the evaluation and selection of a viable, long-term remedial action plan.

Initially, pertinent and available literature, technical reports and analytical data from the existing monitoring and water supply wells in the study area was reviewed. This provided a baseline characterization of the geology, ambient ground water quality and flow direction.

This previous information was incorporated into the design of the Phase IIA well drilling program. The main objective of the Phase IIA program was to evaluate the ground water quality, determine ground water flow direction and map the subsurface geology underlying the site on a preliminary basis. The two specific aquifers that were defined for investigation in the Hunting Ridge Mall Study Area included the overburden/water table aquifer and the bedrock aquifer. Groundwater monitoring was conducted in the two aquifers within four specific zones: water table, overburden/bedrock interface, shallow bedrock and deep bedrock.

During the Phase IIA sampling program, ten monitoring wells were installed at six well cluster locations within the study area. Most well clusters consisted of two or three wells screened at different depths in seperate boreholes in close proximity. The purpose of these well clusters in the hydrogeologic investigation was to determine:

- o Whether independent hydraulic regimes exist in the overburden zone and the competent bedrock zone;

- o The vertical hydraulic relationship and contaminant behavior/migration between the units; and

- o The vertical distribution of contaminants.

The Phase IIA well drilling program commenced in August 1987 and was completed in December 1987. Upon completion of monitoring well installation, all wells were sampled for chemical analysis. Wells were sampled a minimum of two weeks after completion.

Data obtained from the monitoring well boring logs (see Appendix D for boring logs) were organized and incorporated into hydrogeologic maps to illustrate the subsurface hydrogeologic conditions underlying the study area. Potentiometric (ground water flow direction) maps were assembled for the overburden/water table and bedrock aquifers. In addition, a bedrock surface contour map was constructed for the study area, and finally, hydrogeologic cross-sections of the Hunting Ridge Mall Study Area were prepared. These maps and cross-sections are provided later in this section.

The chemical analytical data and the physical hydrogeologic data, based on the information generated by the Phase IIA sampling program, as well as the data from previous investigations, was reviewed. Trends in the data were noted and data gaps identified. This knowledge was utilized in designing the Phase IIB well drilling program. The objective of the Phase IIB program was to provide confirmatory data for defining the nature, extent and source(s) of the ground water contamination.

The Phase IIB drilling program, which commenced in April 1988 and was completed in September 1988, involved the installation of an additional ten monitoring wells at six monitoring well cluster locations.

The following monitoring wells (except for those indicated as existing) were constructed during the Phase IIA and Phase IIB well drilling program in the Hunting Ridge Mall Study Area. The existing wells were those installed on the Mall property by the Mall owner during a previous ground water investigation conducted in 1985.

Phase IIA	Depth (ft)*	Phase IIB	Depth (ft)*
MW-1S (Existing Well)	33	MW-4B	84.3**
MW-2S (Existing Well)	18	MW-6B	159
MW-2M	47		
MW-2B	90	MW-8M	33
		MW-8B	68
MW-3S (Existing Well)	19		
MW-3M	73	MW-9M	71
		MW-9B	124.5
MW-4B	39		
		MW-10M	126
MW-5S	43	MW-10B	180
MW-5M	67		
		MW-12M	61.2
MW-6S	44		
MW-6M	58	MW-13M	110
		MW-13B	154
MW-7S	20.5		
MW-7M	72		

* Depth below ground surface
** Deepened during Phase IIB

Note: MW-#S refers to a shallow (overburden/water table) well
MW-#M refers to a mid-depth (overburden/bedrock interface) well
MW-#B refers to a bedrock well.

For a complete discussion regarding the rationale for the placement of the monitoring wells, refer to Sections 4.2.1 and 4.4.1. The locations of the wells in the study area are also provided in these sections in Figure Nos. 4-7 and 4-9.

4.1.2.2 Soil Boring and Rock Core Sampling

As mentioned in the previous section, soil borings were advanced in each of the well drilling phases (IIA and IIB). At the completion of each boring, a monitoring well was constructed within the borehole. During drilling, split spoon samples were collected in the deepest borehole in each well cluster generally at five foot intervals in the unconsolidated deposits. Split spoon samples were obtained to classify the stratigraphic sequences underlying the study area. The recovered soil samples were inspected and logged characterizing the soil type, color, grain size and moisture content. Selected grain size analyses were performed and the results are presented in Section 4.1.6. In addition, the samples were screened for the presence of organic chemical vapors, and if the samples were suspected of containing significant concentrations of contaminants, they were submitted to a field laboratory for chemical analysis/screening. A representative sample from each split spoon was preserved in a glass sample jar for future reference.

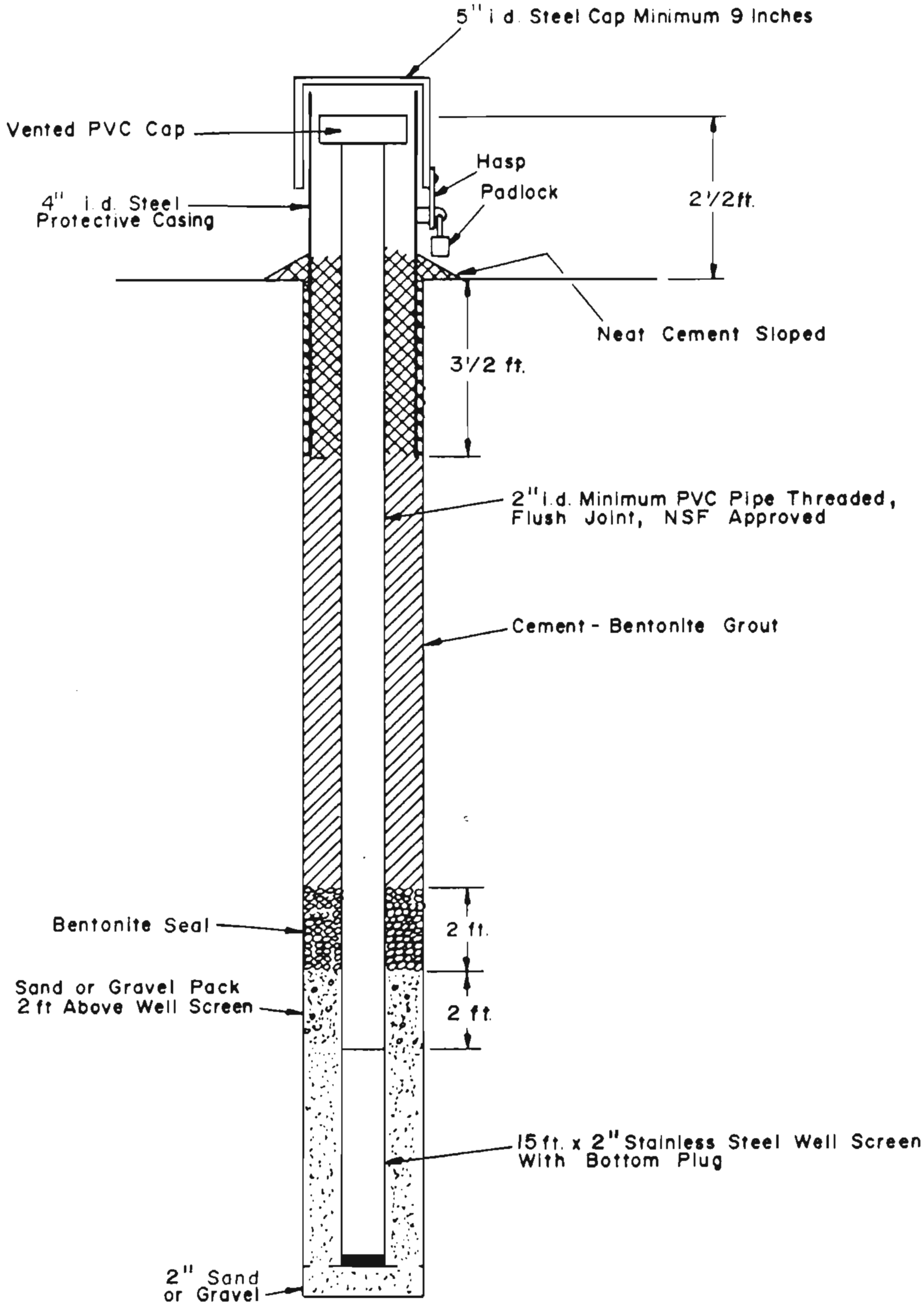
Continuous rock core samples were collected within the bedrock borings. The rock cores were examined and a permanent log was recorded to establish the lithology and physical characteristics of the bedrock unit. A complete visual description of the core was recorded, including the rock type, color, hardness, size and shape of grain (if discernable), sorting, cementation and fractures. The samples of bedrock were stored in labeled core boxes for future reference. These samples were given to the SUNY – New Paltz Geology Department and the New York State Geological Survey in Albany.

4.1.2.3 Well Construction

Shallow Overburden Monitoring Wells

The shallow overburden monitoring wells were designed to intercept and effectively monitor the shallow water table system which exists in the unconsolidated deposits. The shallow wells vary in depth from 18 to 44 feet below ground surface in the study area. Borings were advanced through the overburden zone using hollow stem augers. The augers were of sufficient diameter (four inch inner diameter) to allow for the installation of a two inch diameter stainless steel screen and flush joint, threaded Schedule 40 PVC casing. (Fifteen feet of diameter screen of either 0.006 or 0.01 inch machine cut slots was installed with 10 feet of stainless steel screen situated in the saturated portion of the borehole.) Situating the screen in this manner will monitor and detect any light fractions of organic compounds which may be "floating" on the ground water surface (such as benzene, toulene and xylene) as well as compensate for seasonal variation in ground water levels. A two inch diameter PVC riser extends from the top of the screen to an elevation of at least two feet above ground surface, except where vaults were required.

In constructing the well, the annulus of the borehole was sand–packed to a height of two feet above the screened interval with clean silica sand, and a two foot seal of bentonite pellets was placed immediately above the filter material. The remaining annulus was grouted with a cement/bentonite slurry using a tremie pipe to prevent bridging and to ensure the filling of all voids. Finally, a four inch diameter protective outer steel surface casing with locking cap was installed, except where vaults were used. (See Figure No. 4–3 for an illustration of the construction of a water table well.)



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SHALLOW/WATER TABLE WELL

FIGURE NO. 4-3

Overburden/Bedrock Interface Monitoring Wells

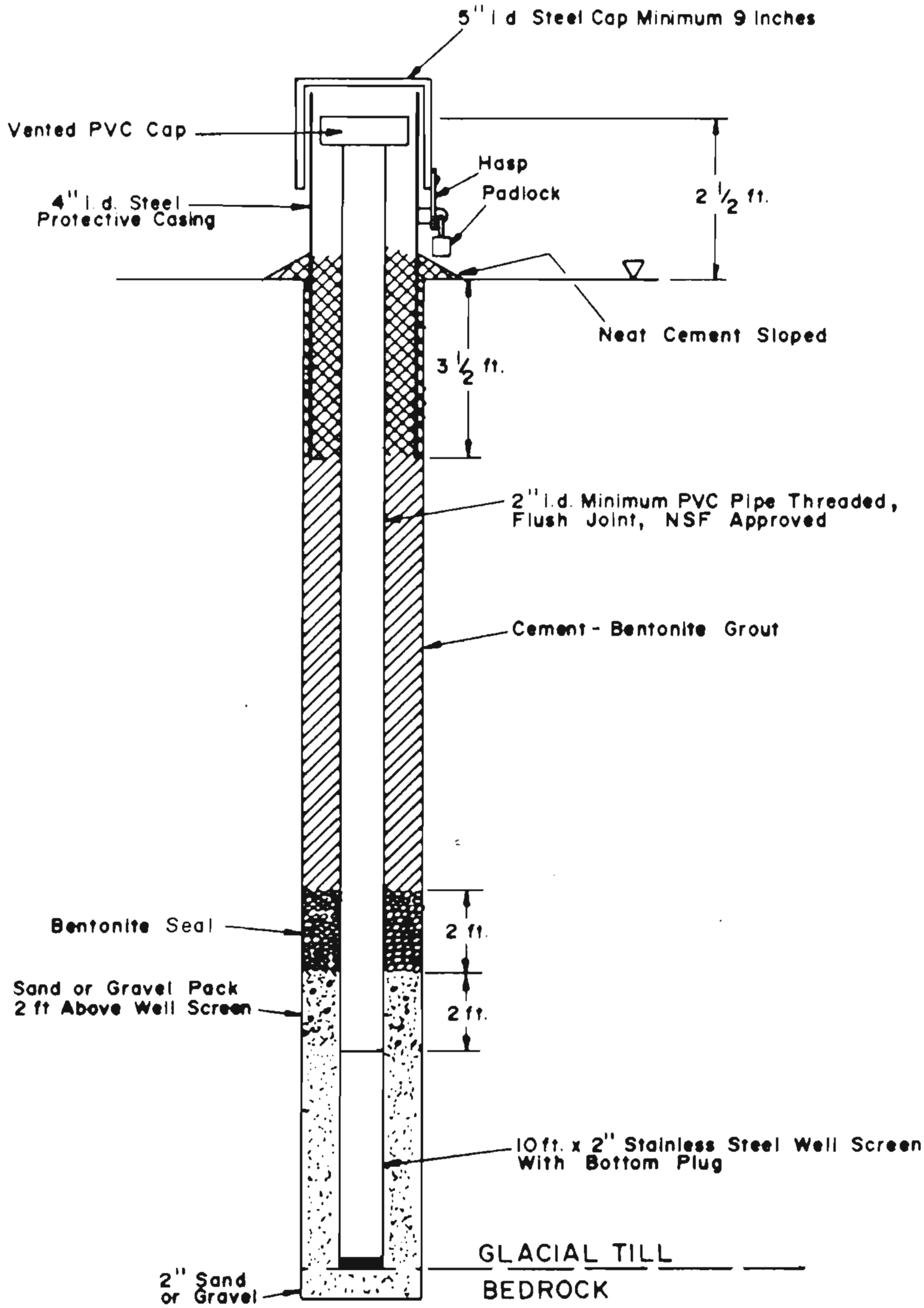
The construction depth of the overburden/bedrock interface monitoring wells varied from 33 feet to 126 feet depending on their location within the river valley and the thickness of the overburden deposits. When constructing the interface monitoring wells, the well screens were situated at the top of the overburden/bedrock interface. Monitoring this zone will detect heavy volatile organic compounds (such as, tetrachloroethene, trichloroethene, cis–1,2–dichloroethene, etc.) that may be found migrating along the bedrock surface. Construction techniques for the interface monitoring wells are the same as those for the shallow overburden wells described above with the exception that 10 feet of screen was installed rather than the 15 feet installed in the shallow overburden wells. (See Figure No. 4–4 for an illustration of the construction of the overburden/bedrock interface well.)

Bedrock Monitoring Wells

Each bedrock well was designed to intercept and monitor the quality of ground water in the upper fractured zone of the bedrock strata. These wells were installed by augering to the bedrock with six inch inner diameter hollow stem augers. When bedrock was encountered, a five foot hole/socket was drilled (roller bit reamed) into rock and a four inch PVC casing was grouted in place with a tremie pipe. The casing was allowed to set for a minimum of 24 hours. Once a secure impermeable seal was established in the rock, an open hole (three inch diameter) was cored into bedrock. Coring (a minimum of 30 feet) was continued until a water bearing fracture zone was encountered. A six inch diameter protective steel surface casing with locking cover was installed over the monitoring well riser pipe, except where vaults were required. (See Figure No. 4–5 for an illustration of the construction of the bedrock well.)

4.1.2.4 Well Development

Well development helps restore the natural hydraulic conductivity of the formation between the well and aquifer. In addition, it removes extraneous drilling fluids that may have been introduced during borehole construction and fine grained sediments in the formation immediately in the vicinity of the well screen to ensure to the maximum extent possible, that turbid–free ground water samples can be obtained. Monitoring wells in the



MID-DEPTH/INTERFACE WELL

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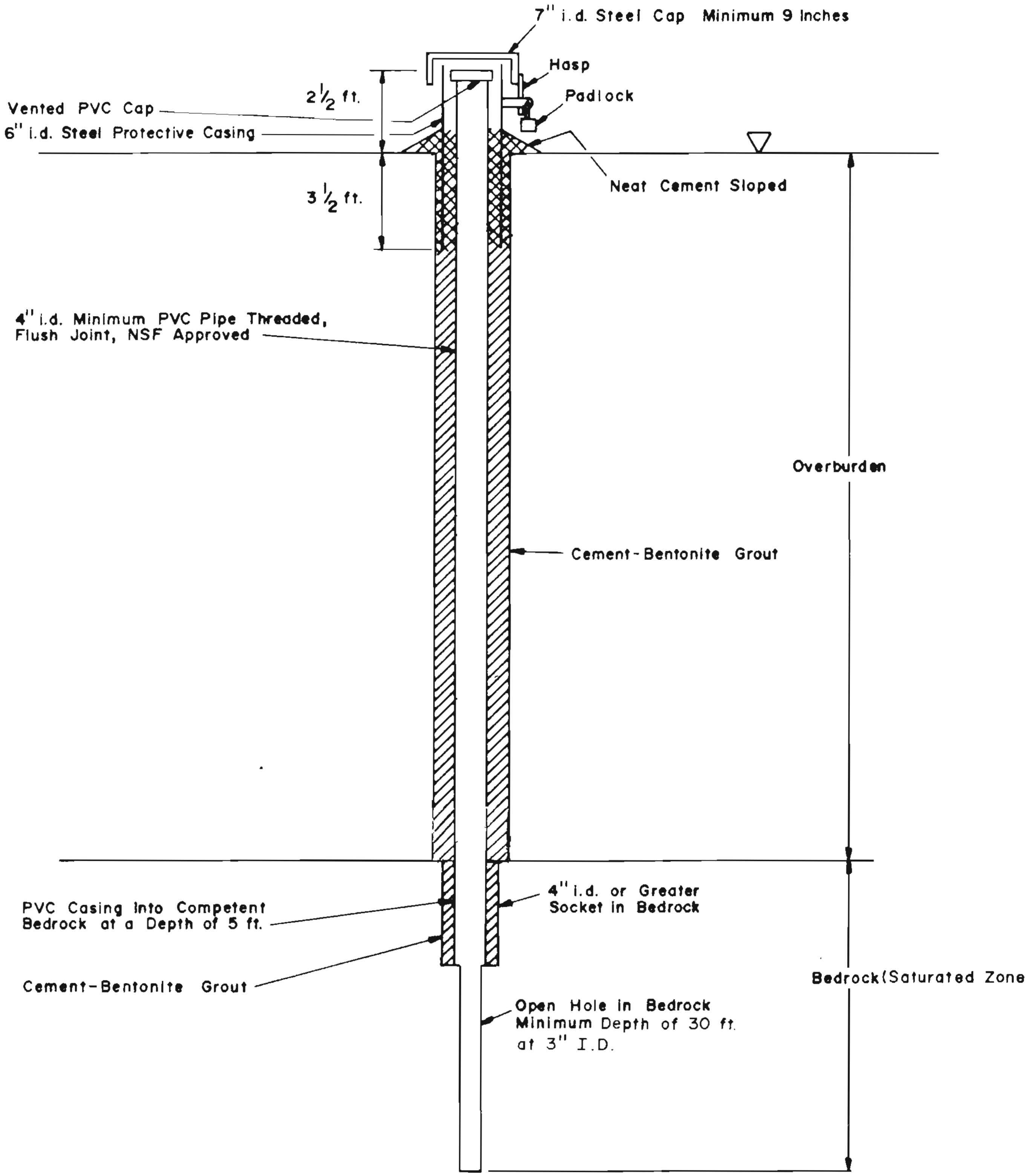
FIGURE NO. 4-4



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DEEP/BEDROCK WELL

FIGURE NO. 4-5

Hunting Ridge Mall Study Area were either developed using an air compressor with an in-line filter, hand bailed with a PVC bailer or evacuated with a PVC hand pump. Water was removed from the wells until it was "clear" as determined by the on-site geologist in consultation with the NYSDEC field representative.

4.1.2.5 Decontamination Procedures

Decontamination of drilling equipment was performed at the designated equipment staging area which was located at the Town of Bedford Highway Department Garage at the end of Crusher Road in Bedford Village. A temporary decontamination pad was constructed at the staging area. The decontamination pad was lined with plastic, bermed and graded so that residual soils and water would drain into the deep portion (sump) of the pad for collection. The contents of the sump were pumped out following each decontamination event and temporarily stored in 55 gallon drums prior to being treated by an activated carbon system and discharged.

Prior to drilling the first well and following the completion of drilling at each borehole, all down-hole equipment (augers, rods, plugs, etc., including the drilling rig) was brought to the decontamination pad and steam cleaned.

The procedures followed for decontamination of the split spoon samplers involved removing gross contamination and soil residue using a potable water rinse. This was followed by washing the split spoons with a solution of potable water and Alconox soap. The split spoon samplers were then rinsed with distilled water.

4.1.3 Organic Vapor Screening of Soil Samples

As described above, as part of the construction of each monitoring well, soil samples were obtained using a split spoon sampler at 5 foot intervals. These soil samples were used to classify the stratigraphic units underlying the study area. In addition, immediately upon retrieval of the split spoon sampler, a representative soil sample was collected in a six ounce drilling jar which was tightly capped. Approximately a one inch head space was allowed between the soil sample and cap so that soil gases could equilibriate in the void/head space.

The soil sample was allowed to warm up for a period of approximately 10 minutes. Using a Century Organic Vapor Analyzer (OVA), Model 128 (flame ionization detector), a probe was quickly introduced into the head space and a reading of the total volatile organic compounds was recorded in relation to depth on the Well Log Forms.

The values recorded were used in interpreting and differentiating zones of contamination in the unconsolidated deposits underlying the study area. Soil samples which recorded significant volatile organic head space values were collected and sent to a field laboratory for chemical screening analysis. The results of the soil screening with the OVA are provided on the boring logs in Appendix D, and the results of screening by the field laboratory are presented in Table 4-2.

4.1.4 Soil Gas Survey

There exist three distinct hydrogeologic zones within the unconsolidated sediments underlying the site. One is the zone of saturation (or phreatic zone) in which all the voids between the soil grains are filled with fluid. This zone is monitored at the site utilizing wells which provide representative ground water samples from the formation.

Located above the zone of saturation is the capillary fringe. The capillary fringe is a zone in which the voids between soil particles are only partially filled with fluid as a result of capillary forces.

Above the capillary fringe is the vadose zone or more commonly referred to as the unsaturated zone. Within this zone, the voids between the soil particles are filled with vapor/gas. Under ideal conditions the gas trapped in the soil can exhibit similar volatile organic chemical qualities as the ground water beneath.

Soil gas sampling and analysis can be utilized as a reconnaissance tool to monitor the vadose zone and which at times can reduce the time and costs associated with locating and delineating plumes of ground water contamination (as well as areas of contaminated soil). Once the data from the soil gas survey is examined, it is necessary to confirm the results with analysis of soil and ground water samples. The mapping of soil gas contaminant concentrations can assist in designing the placement of the soil borings and the ground water monitoring network.

Table No. 4–2

SOIL SAMPLE SCREENING

Phase IIA

Sample Number	Sample Location	Date Collected	Matrix	Tetra-chloro-ethene (ppb)	Tri-chloro-ethene (ppb)	1,2-Di-chloro-ethene (ppb)	Benzene (ppb)	Toluene (ppb)	Xylene (ppb)
B38734901	MW–5M (5–7')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734902	MW–5M (10–12')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734903	MW–5M (15–17')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734904	MW–5M (20–22')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734905	MW–5M (25–27')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734906	MW–5M (30–32')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734907	MW–5M (35–37')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734908	MW–5M (40–42')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734909	MW–5M (45–47')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734910	MW–5M (55–57')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734911	MW–5M (60–62')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734912	MW–6M (5–7')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734913	MW–6M (10–12')	12/13/87	soil	ND	1560	ND	ND	ND	ND
B38734914	MW–6M (15–17')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734915	MW–6M (20–25')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734916	MW–6M (25–27')	12/13/87	soil	ND	62	ND	ND	ND	ND
B38734917	MW–6M (30–32')	12/13/87	soil	ND	15	ND	ND	ND	ND
B38734918	MW–6M (35–37')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734919	MW–6M (40–42')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734920	MW–6M (45–47')	12/13/87	soil	ND	ND	ND	ND	ND	ND
B38734921	MW–6M (50–52')	12/13/87	soil	ND	ND	ND	ND	ND	ND

Note: ND – Not Detected

Table No. 4–2 (continued)

SOIL SAMPLE SCREENING

Phase IIB

Sample Number	Sampling Point	Tetra-chloro-ethene (ppb)	Tri-chloro-ethene (ppb)	Trans-1,2-Dichloro-ethene (ppb)	1,1-Di-chloro-ethene (ppb)	1,1,1-Tri-chloro-ethane (ppb)	Vinyl Chloride (ppb)	Benzene (ppb)	Toluene (ppb)	Xylene (ppb)
388–195–03	MW–12M (30–32')	ND	4.9	ND	ND	ND	ND	ND	1.6	ND
388–168–01	MW–13M (5–7')	ND	6.4	ND	ND	ND	ND	ND	ND	ND
388–168–02	MW–13M (10–12')	ND	7.3	ND	ND	ND	ND	ND	ND	ND
388–168–03	MW–13M (15–17')	ND	6.6	ND	ND	ND	ND	ND	ND	ND
388–168–04	MW–13M (20–22')	ND	7.2	ND	ND	ND	ND	ND	ND	ND
388–168–05	MW–13M (25–27')	ND	8.5	ND	ND	ND	ND	ND	ND	ND
388–169–01	MW–13M (30–32')	ND	8.6	ND	ND	ND	ND	ND	ND	ND
388–169–02	MW–13M (35–37')	ND	8.7	ND	ND	ND	ND	ND	ND	ND
388–169–03	MW–13M (40–42')	ND	7.2	ND	ND	ND	ND	ND	ND	ND
388–169–04	MW–13M (45–47')	ND	9.2	ND	ND	ND	ND	ND	ND	ND
388–169–05	MW–13M (50–52')	ND	35.5	ND	ND	ND	ND	ND	ND	ND
388–169–06	MW–13M (55–57')	ND	6.2	ND	ND	ND	ND	ND	ND	ND
388–169–07	MW–13M (60–62')	ND	6.7	ND	ND	ND	ND	ND	ND	ND
388–169–08	MW–13M (65–67')	ND	9.6	ND	ND	ND	ND	ND	ND	ND
388–169–09	MW–13M (70–72')	ND	7.0	ND	ND	ND	ND	ND	ND	ND
388–170–01	MW–13M (83–85')	ND	7.4	ND	ND	ND	ND	ND	ND	ND
388–170–02	MW–13M (88–90')	ND	6.6	ND	ND	ND	ND	ND	ND	ND
388–170–03	MW–13M (98–100')	ND	7.9	ND	ND	ND	ND	ND	ND	ND
388–173–01	MW–13M (108–110')	ND	7.5	ND	ND	ND	ND	ND	ND	ND
388–173–02	MW–13M (118–120')	ND	7.2	ND	ND	ND	ND	ND	ND	ND

Note: ND – Not Detected

The New York State Department of Environmental Conservation (NYSDEC) retained the services of the United States Environmental Protection Agency (USEPA) to conduct a soil gas survey in the Hunting Ridge Mall Study Area as part of the Remedial Investigation. Samples were obtained at 61 locations in the study area as shown in Figure No. 4-6.

The analytical data generated from the soil gas sampling indicated the presence of tetrachlorethene and trichloroethene in the subsurface. A contour map was prepared that illustrated the location of the concentration gradients identified in the study area (see Figure No. 4-6).

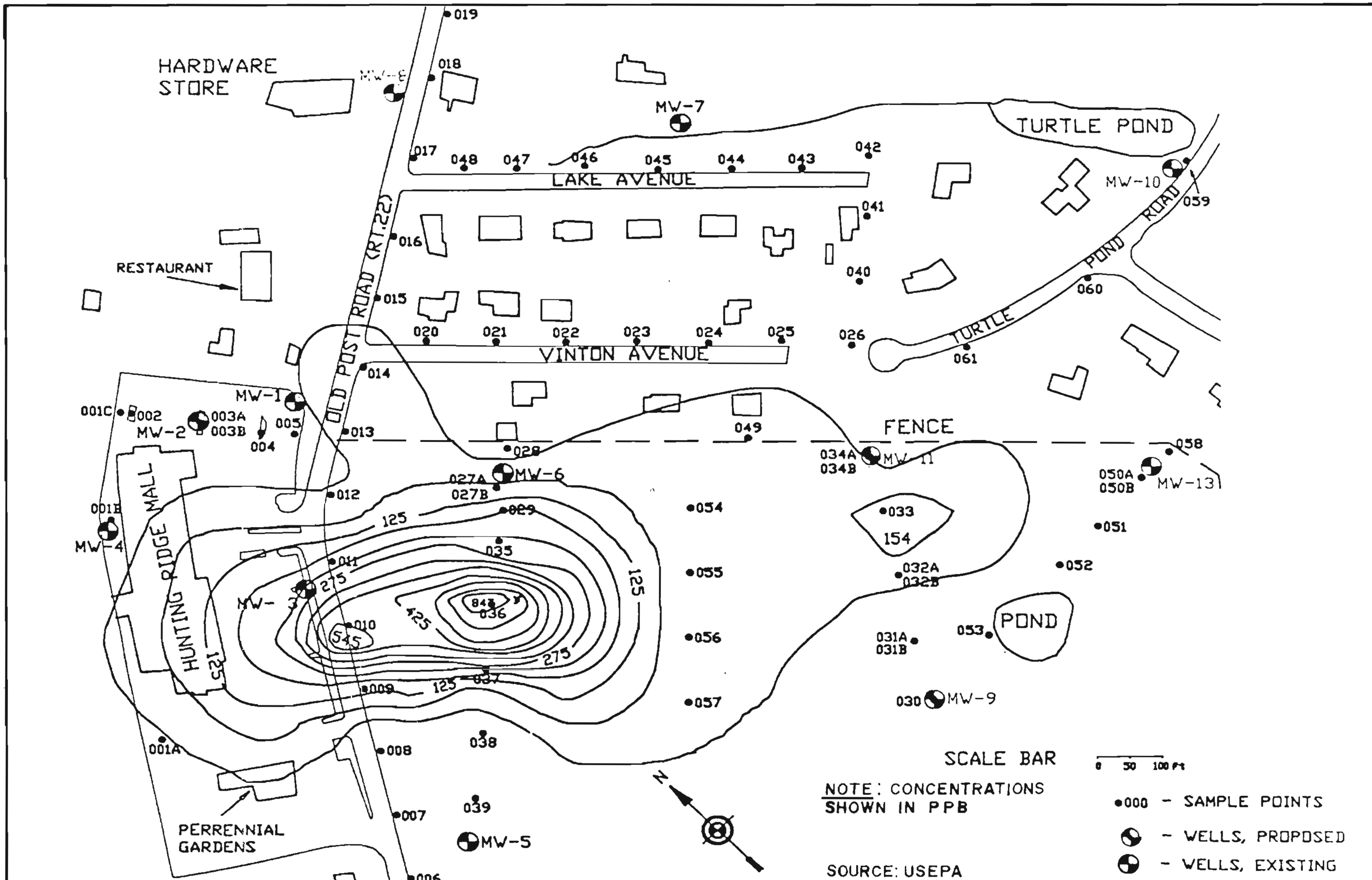
According to the soil gas contour map, the ground water contaminant plume is approximately 400 feet wide and migrating southeast from the suspected source in the Hunting Ridge Mall roughly parallel to Vinton Avenue. The area in which the highest concentration of contaminants was detected is in the wooded area, downgradient from the Mall, approximately 200 feet southeast of Route 22. The soil gas contours of the plume extend up to 1,000 feet southeast of the Mall and Route 22.

The results of the soil gas investigation were used in the planning and design of the Phase IIB well drilling program. For a review of the soil gas report prepared by USEPA, refer to Appendix E.

4.1.5 Borehole Logging Tests

Downhole borehole logging was performed at two bedrock borehole locations (MW-4 behind the Mall building and MW-6 located in the Ponds Development Area) within the Hunting Ridge Mall Study Area. The downhole borehole logging tests included caliper, resistivity, gamma-ray and specific potential logging. The following provides a brief review of the type and rationale for each of the logging tests performed.

Caliper – The caliper log provided a continuous record of borehole diameter. These logs are useful in determining the location and extent of openings in the sides of the borehole caused by caving, fracturing and solutioning.



SOIL GAS SURVEY
STATION LOCATIONS AND RESULTS

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FIGURE NO. 4-6

Electrical Resistivity – The electrical resistivity logs form a continuous record of the resistance to flow of an electrical current from points within the borehole to an electrical ground at land surface. Sandstone units containing fresh water have a high resistance, while shales have a low resistance. This log is useful for determining lithology and stratigraphic correlation as well as the presence of water producing fractures in bedrock of low porosity.

Spontaneous Potential – The spontaneous potential logs record small differences in voltage that develop at the contact of the borehole fluid, the surrounding rock and the water in the aquifer. The logs are used for determining lithology, predominantly with regard to shale and clay content.

Gamma-Ray – Natural gamma logs indicate the amount of natural gamma radiation emitted by the rock surrounding the borehole. In general, shales give off more radiation than sandstones or carbonate rocks, typically because of their potassium content. Consequently, the logs are useful in determining lithology and in making stratigraphic correlations.

The predominant rationale for performing downhole logging at the two well locations within the Hunting Ridge Mall Study Area was to obtain a better understanding of the degree of fracturing within the metamorphic bedrock and the pathway by which contaminants are migrating through the bedrock zone. These wells were the deepest drilled as part of the Remedial Investigation.

The MW-4B monitoring well location was chosen because of its close proximity to the Mall sanitary and stormwater drainage systems which are suspected sources of contaminant release. The MW-6B monitoring well location was chosen because it is in an area in which some of the highest concentrations of contaminants had been detected in ground water within the study area.

A review of the downhole borehole logging tests performed on monitoring well MW-4B (located directly behind the Hunting Ridge Mall building) indicates that the gneiss bedrock underlying the site in this area is relatively massive and very competent in structure. Overall, the caliper log did not detect significant zones of fracturing within the gneiss. The resistivity, spontaneous potential and gamma data obtained from the tests yielded small amounts of information and little can be determined regarding the ground water flow pathway within this zone. The anomalies noted in the gamma log are probably influenced by locally high concentrations of potassium feldspar crystals within the gneiss bedrock.

A review of the downhole borehole logging tests performed on monitoring well MW-6B (located southeast of the Mall on the Ponds Development Property) indicates that the Gneiss bedrock underlying the site in this area is also relatively massive and competent in structure. Overall, the caliper log did not detect significant zones of fracturing within the gneiss. The resistivity, spontaneous potential and gamma data obtained from the tests performed provided little information and specific depths of potential contaminant migration within this zone cannot be determined.

4.1.6 Permeability

For the purpose of this investigation, permeabilities were estimated by applying the Hazen Equation to grain size analysis curves. The grain size analysis curves were generated from soil samples that were collected at the screened intervals of monitoring wells MW-3M, MW-6M and MW-7M which are located downgradient of the Hunting Ridge Mall and are representative of the geology in the study area. The grain size analyses are contained in Appendix F.

The Hazen Equation is $K = Ad^2_{10}$, where the parameter K represents permeability. The parameter d_{10} represents effective grain size and is taken directly from the grain size gradation curve as determined by sieve and hydrometer analysis. It is the grain size diameter at which 10% by weight of the soil particles are finer and 90% are coarser. For K in cm/s and d_{10} in mm, the coefficient A is equal to 1.0.

The following are permeability calculations for unconsolidated sediments collected from the screen depths of MW-3M, MW-6M and MW-7M.

MW-3M (60 to 72 feet)

$d_{10} = 0.01$

$K = 1.0\ (0.01)^2$

$= 1.0 \times 10^{-4}$ cm/sec

Silt, little fine sand.

MW–6M (45 to 57 feet)

$d_{10} = 0.074$

$K = 1.0\ (0.074)^2$

$= 5.476 \times 10^{-3}$

Fine to coarse sand, little silt.

MW–7M (45 to 67 feet)

$d_{10} = 0.04$

$K = 1.0\ (0.04)^2$

$= 1.6 \times 10^{-3}$

Fine to medium sand, some silt.

The above calculations display relatively uniform high permeability values which are characteristic of the generally clean, well sorted sands found in the study area. A slightly lower permeability value was obtained at the MW–3M 60 to 72 foot screened interval where the medium to coarse sand was absent and a higher silt content was found. By comparing the grain size descriptions noted in the boring logs with the corresponding permeability values, it appears that the glacial stratified drift deposits overlying the bedrock in the study area are relatively isotropic (a medium whose properties are the same in all directions).

4.1.7 Water Level Measurements

After the monitoring wells were installed in the study area, a permanent reference point was established on the top of the PVC riser pipe casing by scribing. This reference point was surveyed to an accuracy of 0.01 feet in relation to mean sea level. Water levels were periodically measured to an accuracy of 0.01 feet in all wells, and the data recorded on a log. Ground water elevations were obtained utilizing an electronic water level indicator (Slope Indicator Model 51453). Water level measurements provided the necessary base line data in the study area for:

- Calculating the direction and magnitude of lateral and vertical hydraulic gradients within the unconsolidated and bedrock units.

- Determination of fluctuation/seasonal variation in water levels.

- Determination of hydraulic interconnection between the shallow and deep water table zones.

The results of the ground water levels obtained during the Remedial Investigation are presented later in Section 4.7.2.

4.1.8 Ground Water Sampling

4.1.8.1 Well Evacuation

Ground water in the well column can be effected by pressure, degassing and prolonged contact with the well construction materials. Standing water within the well may not be representative of in-situ ground water quality. Therefore, it is essential to evacuate the standing water in the well and filter pack so that it can be replaced with representative formation ground water.

Fluorocarbon resin/Teflon bailers were utilized in evacuating three well volumes from each monitoring well prior to sampling. Pre-cleaned (decontaminated) bailers were incorporated in the evacuation procedure to minimize the potential of introducing contamination into the monitoring wells. In addition, precautionary measures, such as using clean gloves, dedicated braided nylon cord, and plastic sheeting placed around the well head during the purging and sampling procedures, were exercised.

4.1.8.2 Sample Withdrawal, Preservation and Handling

Once three well volumes of ground water were removed, sample containers provided by the analytical laboratory were taken from the coolers and filled with ground water samples obtained from the same bailer which was utilized in purging the monitoring well. Samples were transferred directly from the bailer into the laboratory containers.

Since many of the chemical constituents and physiochemical parameters that were measured in the ground water monitoring program are not chemically stable, sample preservation was required. Sample preservation is generally intended to retard biological action, retard hydrolysis and reduce absorption effects. Preservation methods which were required by the NYSDEC 1986 Contract Laboratory Protocol (CLP) and utilized included pH control by chemical addition, refrigeration and protection from light.

Upon completion of daily sampling, Chain-of-Custody Forms were completed and the sample coolers were delivered to the laboratory within 48 hours as specified by NYSDEC.

4.2 Description of the Phase IIA Sampling Program

This section reviews the specific components and associated activities of the Phase IIA sampling program.

The objective of the Phase IIA sampling program was to collect and analyze subsurface (soil and ground water) data from the Hunting Ridge Mall Site and the surrounding area. As described in Section 4.1.2, as a means of developing this information, soil borings and monitoring wells were installed. Soil samples were obtained from the borehole and screened in the field by utilizing a portable organic vapor analyzer (OVA). After screening by the OVA, a number of soil samples were selected for chemical analysis at the New York State Department of Environmental Conservation (NYSDEC) laboratory in Saratoga, or with an in-field Gas Chromatograph (GC) provided through NYSDEC and located in Spring Valley. Once the monitoring wells were constructed, representative ground water samples were collected and sent to a NYSDEC certified laboratory for analysis. The analytical data generated as part of the Phase IIA sampling program, complimented by the data produced in the Phase IA sampling program, made it possible to identify on an initial basis, the location of the sources of contamination, to assess the surficial transport and subsurface migration pathway, and extent of contaminants in the study area, as well as to assist in making decisions on specific sampling locations for the Phase IB and IIB components of the Remedial Investigation.

The following activities were undertaken prior to and during the Phase IIA sampling program:

- o Pertinent, available literature, and technical reports and data were reviewed. These included:
  - Dvirka and Bartilucci Consulting Engineers "Remedial Investigation – Interim Report Phase IA Sampling Program (Hunting Ridge Mall), December 1987."

- Leggette, Brashers and Graham, Inc. "Ground Water Assessment, Town of Bedford, New York, December 1985."

- C.A. Rich Consultants. "Soil Sampling and Analysis, Hunting Ridge Mall, Bedford, NY., September 1985."

- C.A. Rich Consultants. "Monitoring Well Report for the Hunting Ridge Mall, Bedford, NY., February 1985."

- Westchester County Department of Health, "Interim Report, Investigation of the Occurrence of Volatile Organic Chemicals in Well Water Supplies in the Vicinity of Lake Avenue and Vinton Avenue, in the Town of Bedford, New York, October 1983."

o Oversight was provided for a limited tap water sampling program conducted at residences along Lake and Vinton Avenues by the Westchester County Department of Health (WCDH) in September, 1987. The program was conducted by personnel from the WCHD with review provided by a representative of Dvirka and Bartilucci Consulting Engineers. Some private well depth measurements and analytical data obtained from WCDH were confirmed and expanded upon as a result of discussions with the local homeowners.

o Aerial photographs of the study area were obtained to provide the most recent information on land use patterns, potential sources of contamination, local topography and drainage patterns. In addition, aerial topographic contour maps (five foot contour intervals) were produced to further enhance the understanding of surficial and subsurface drainage patterns in the area.

o Data generated from the seismic survey conducted during Phase IA of the investigation was reviewed and incorporated in to the design and analysis of the results of the Phase IIA sampling program. This seismic survey was undertaken to obtain data on depth to and slope of bedrock, and depth to ground water in the Mianus River Valley/study area.

o Ten monitoring wells were constructed at six locations.

- o All monitoring wells constructed as part of the Phase IIA sampling program, as well as the three existing ground water monitoring wells installed previously by the Hunting Ridge Mall owner, were sampled and surveyed, and ground water level readings were obtained and recorded. These measurements supplied the necessary data for determining ground water flow direction underlying and in the immediate vicinity of the site.

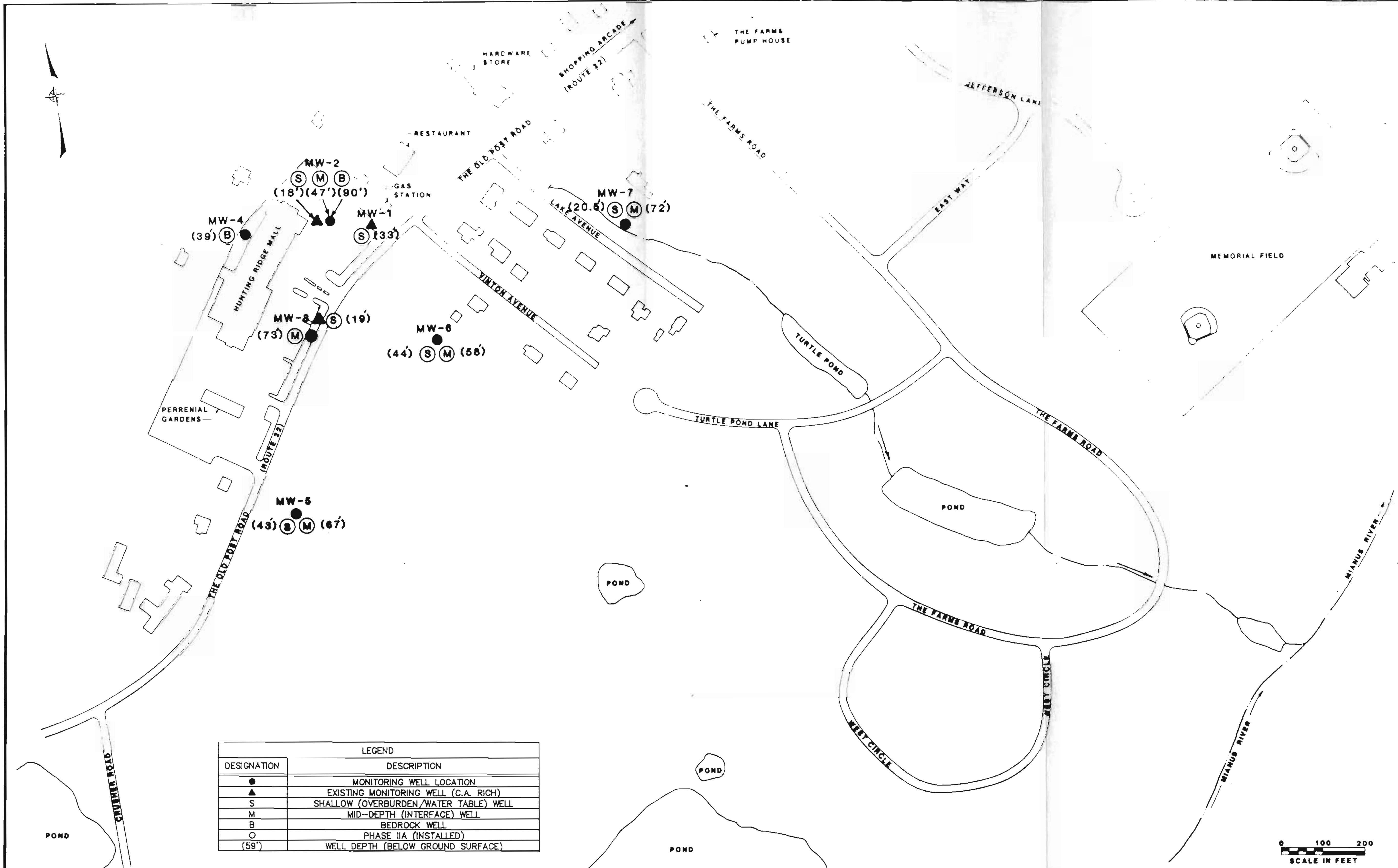
4.2.1 Selection of Ground Water Monitoring Well Locations

This section reviews the rationale for selecting the various Phase IIA monitoring well locations.

In part, as discussed previously, the rationale for the overall selection of monitoring well locations was based on the analytical data generated by prior ground water investigations, the analytical data obtained from the Phase IA sampling program, the location of the suspected source(s) of contamination, and the pre-supposition that ground water is flowing toward and discharging to the Mianus River.

The following table summarizes the well depths for each monitoring well which was constructed in Phase IIA in the Hunting Ridge Mall Study Area. The locations of the wells are illustrated in Figure No. 4-7.

Phase IIA Wells	Location	Depth (ft)*
MW-1S (existing)	East corner of Mall parking lot	33
MW-2S (existing)	Adjacent to the east corner of	18
MW-2M	the Mall building	47
MW-2B		90
MW-3S (existing)	In the parking lot in front of the	19
MW-3M	Mall adjacent to Route 22	73
MW-4B	Directly in back of the Mall building and the dry cleaning establishment	39
MW-5S	South of the Mall on the Ponds	43
MW-5M	Development Property	67
MW-6S	Southeast of the Mall on the Ponds	44
MW-6M	Development Property	58



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION
▲	EXISTING MONITORING WELL (C.A. RICH)
S	SHALLOW (OVERBURDEN/WATER TABLE) WELL
M	MID-DEPTH (INTERFACE) WELL
B	BEDROCK WELL
O	PHASE IIA (INSTALLED)
(59')	WELL DEPTH (BELOW GROUND SURFACE)

NO.	DATE	REVISION	INT.

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Syosset New York

BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
PHASE IIA
MONITORING WELL LOCATIONS

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 4-7

Phase IIA Wells	Location	Depth (ft)*
MW-7S MW-7M	East of the Mall adjacent to the stream bed on Lake Avenue	20.5 72

* Depth below ground surface

Note: MW-#S refers to a shallow (overburden/water table) well
MW-#M refers to a mid-depth (overburden/bedrock interface) well
MW-#B refers to a (shallow) bedrock well

Of the three existing shallow (overburden/water table) wells, the locations of MW-2 and MW-3 were selected to install complimentary monitoring wells because these wells had the highest concentrations of contamination in previous sampling. A mid-depth (overburden/bedrock interface) and a bedrock monitoring well were installed adjacent to the existing water table well at MW-2. Also, complimenting the existing water table well at MW-3, a mid-depth (interface) well was constructed at this location. The well clusters at MW-2 and MW-3 provide information pertaining to the migration of contamination beneath the site, and potentially to areas downgradient of the Hunting Ridge Mall property boundary.

In addition to these complimentary wells, Phase IIA included the construction of three new shallow (water table) monitoring wells, three mid-depth (interface) wells and one bedrock well. The following is a discussion of the rationale for the placement of these seven ground water monitoring wells in the study area.

- o The bedrock well installed at the MW-4 location provided ground water quality data for the area immediately adjacent to the suspected source of ground water contamination (the Mall sanitary system and stormwater drainage system).

- o The well clusters installed at MW-5 and MW-6 provided data on ground water quality in the area located immediately south and southeast (downgradient) of the Hunting Ridge Mall Site.

- o The well cluster installed at MW–7 provided data on ground water quality in the area east of the Mall and assisted in determining if this area is impacted by a suspected secondary source of contamination due to past discharges to the stormwater drainage system of the Hunting Ridge Mall and contamination of the stream bed along Lake Avenue.

4.2.2 Analytical Parameters

For all Phase IIA samples collected, laboratory analysis was conducted to determine the presence of volatile organic chemicals (VOCs) including, but not limited to, tetrachloroethene, trichloroethene, cis/trans–1,2–dichloroethene, vinyl chloride, 1,1,1–trichloroethane, benzene, toulene and xylene (the analytes of concern in the study area). In addition, approximately 50 percent of the samples obtained were analyzed for the Hazardous Substance List (HSL) compounds.

4.2.3 Location of Background Ground Water Monitoring Well

The Phase II well drilling program was designed to confirm data obtained in the past, and to better define the suspected source(s) and extent of contamination in the study area in order to develop an appropriate remedial action, if required. At the completion of the Phase IIA program, ground water flow patterns were determined in the water table zone as well as at the overburden/bedrock interface.

As part of the Phase IIB well drilling program, the well behind the Mall (MW–4B) was deepened and designated (with NYSDEC approval) as the upgradient monitoring well at the Hunting Ridge Mall Site. Representative ground water samples were collected at this site as a control in the program to document the ambient quality of ground water. This provides better definition of the suspected source and degree of contamination in the study area.

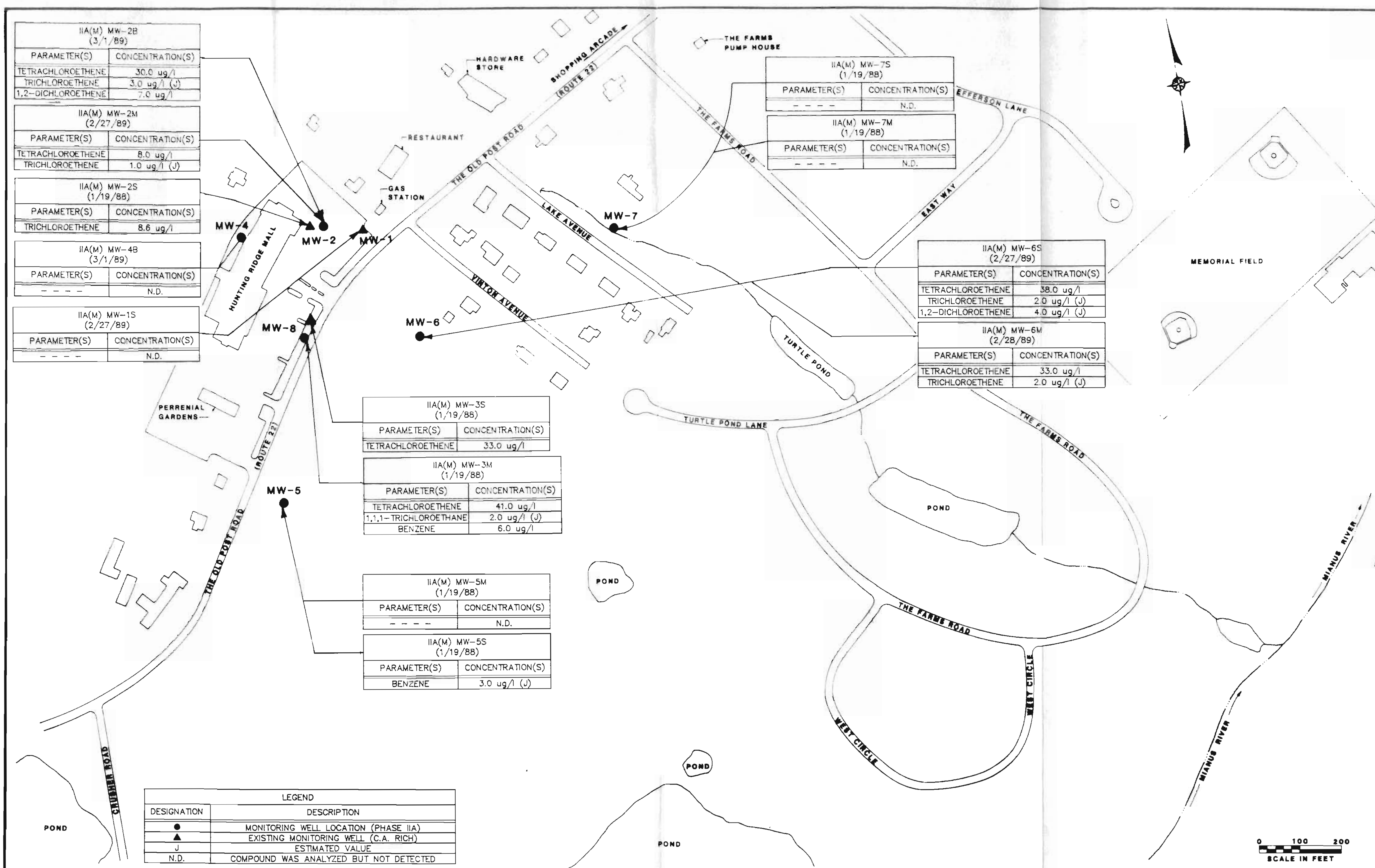
4.3 Analytical Results of the Phase IIA Sampling Program

The purpose of this section is to present the analytical results of samples which were collected during the baseline component of the ground water sampling program. The purpose of obtaining and analyzing these samples is threefold. First, re–sampling the existing wells installed by the owner of the Mall might confirm previous analytical results/contamination obtained by others. Second, the evaluation of the data would assist in determining where and how the analytes of concern are moving through the ground water system in the study area and to determine/confirm possible sources of contamination, and third, the results of the sampling effort would assist in the design of future phases of the sampling program.

Figure No. 4–8 presents a map of the study area which identifies the locations in the Hunting Ridge Mall Study Area from which ground water samples were collected, along with the analytical results of each sample for the analytes of concern and other organic and inorganic contaminants detected. For purposes of presenting the sampling program results, each sampling point is identified by an identification number. For example, for a sampling point labeled "IIA (M) MW–1S," The "IIA" portion of the identification number indicates that the sample was collected during the Phase IIA portion of the sampling program. The "(M)" of the sample identification number designates that the sample was collected from within the Hunting Ridge Mall Study Area. The next portion of the sample identification is the prefix MW– followed by a number such as "1," "2," "3," etc., through "7." This identifies the sample as being taken from a monitoring well and the specific location/identification of that well. The last element of the sample identification number is either a "S," "M" or "B", which indicates whether the monitoring well is shallow (water table), mid–depth (interface) or a bedrock well, respectively.

This sample identification number is also used on the Chain–of–Custody Forms and Field Log Forms. As such, background information regarding each sampling location including Location Sketches, field personnel involved, date and time of sample collection, meteorological conditions, etc., can be obtained from the forms which are contained in the Field Report (separate document) by cross referencing the forms to the appropriate sample identification number from Figure No. 4–8.

In the following sections, the sequence of data presentation will be by proximity to the suspected source in the study site. For each location, there is a presentation of organic and inorganic sampling results for the compounds detected. Cases where analytes of concern were reported are specifically discussed.



IIA(M) MW-2B (3/1/89)	
PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	30.0 ug/l
TRICHLOROETHENE	3.0 ug/l (J)
1,2-DICHLOROETHENE	7.0 ug/l

IIA(M) MW-2M (2/27/89)	
PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	8.0 ug/l
TRICHLOROETHENE	1.0 ug/l (J)

IIA(M) MW-2S (1/19/88)	
PARAMETER(S)	CONCENTRATION(S)
TRICHLOROETHENE	8.6 ug/l

IIA(M) MW-4B (3/1/89)	
PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IIA(M) MW-1S (2/27/89)	
PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IIA(M) MW-7S (1/19/88)	
PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IIA(M) MW-7M (1/19/88)	
PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IIA(M) MW-6S (2/27/89)	
PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	38.0 ug/l
TRICHLOROETHENE	2.0 ug/l (J)
1,2-DICHLOROETHENE	4.0 ug/l (J)

IIA(M) MW-6M (2/28/89)	
PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	33.0 ug/l
TRICHLOROETHENE	2.0 ug/l (J)

IIA(M) MW-3S (1/19/88)	
PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	33.0 ug/l

IIA(M) MW-3M (1/19/88)	
PARAMETER(S)	CONCENTRATION(S)
TETRACHLOROETHENE	41.0 ug/l
1,1,1-TRICHLOROETHANE	2.0 ug/l (J)
BENZENE	6.0 ug/l

IIA(M) MW-5M (1/19/88)	
PARAMETER(S)	CONCENTRATION(S)
- - - -	N.D.

IIA(M) MW-5S (1/19/88)	
PARAMETER(S)	CONCENTRATION(S)
BENZENE	3.0 ug/l (J)

LEGEND

DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION (PHASE IIA)
▲	EXISTING MONITORING WELL (C.A. RICH)
J	ESTIMATED VALUE
N.D.	COMPOUND WAS ANALYZED BUT NOT DETECTED

NO.	DATE	REVISION	INT.

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PROJECT ENGINEER: DRAWN BY: DESIGNED BY: CHECKED BY:

Dvirka and Bartilucci CONSULTING ENGINEERS Syosset New York

BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
PHASE IIA
ORGANIC CHEMICAL SAMPLING RESULTS

PROJECT NO. 842
DATE
SCALE: AS NOTED
FIGURE NO. 4-8

A summary of the organic and inorganic analytical results of samples collected in the Hunting Ridge Mall Study Area as part of the Phase IIA program are presented in tabular format in Table No. 4-3. Samples reporting results for inorganic analyses were also analyzed for pesticides/PCBs, volatiles and semi-volatiles. All other samples were analyzed for volatiles only.

It is important to note that as shown in Table No. 4-3, multiple samples were obtained and analyzed at several locations during the Phase IIA sampling program because some of the initial analyses did not meet NYSDEC QA/QC requirements for Hazardous Substance List (HSL) analysis and the results were deemed invalid. All resampling results were analyzed for Target Compound List (TCL) constituents. Therefore, only those analytical results that met the NYSDEC QA/QC requirements for HSL and/or TCL analysis and resultant valid data is shown in both Table No. 4-3 and Figure No. 4-8, and presented in this report for discussion.

As listed in Table No. 4-3, where a compound was not measured in a sample, the data is presented using the following qualifiers:

- o A blank space indicates that the analysis of the compound did not meet the NYSDEC CLP QA/QC requirements and was therefore deemed invalid and not shown.

- o The symbol "ND" indicates that the analysis of this compound met the NYSDEC CLP QA/QC requirements, but was not measured above the analytical instrument's detection limits (IDL).

- o The symbol "NA" indicates that the compound was not analyzed.

Qualifiers that accompany the concentrations reported in the table are the NYSDEC CLP concentration qualifiers.

In addition, several sample results show the presence of unknown isomers and "other" compounds. These compounds are listed in the table and presented in the text, however, identification and determination of the exact levels of the compounds, as well as a discussion of their presence and extent of contamination is not definable within the context of this program and will be excluded from discussions. In order to more clearly identify and define possible contamination by these compounds, additional sampling would be necessary with the primary focus of analysis based on these parameters.

Table No. 4-3

BEDFORD VILLAGE
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
HUNTING RIDGE MALL PHASE IIA SAMPLING PROGRAM
ANALYTICAL RESULTS

PARAMETERS	IIA(M)MW1S 1/22/88 ** (ug/l)	IIA(M)MW1SA 2/27/89 (ug/l)	IIA(M)MW2S 1/19/88 (ug/l)	IIA(M)MW2M 1/21/88 + (ug/l)	IIA(M)MW2MA 2/27/89 (ug/l)	IIA(M)MW2B 1/22/88+ (ug/l)	IIA(M)MW2BA 3/1/89 (ug/l)	IIA(M)MW3S 1/19/88 (ug/l)	IIA(M)MW3M 1/19/88 (ug/l)
Volatiles:									
Acetone		ND	45.0 B		12.0		ND	9.8 JB	60.0 B
Benzene		ND	ND		ND		ND	ND	6.0
Bromodichloromethane		ND	ND		ND		ND	ND	ND
Bromoform		ND	ND		ND		ND	ND	ND
Bromomethane		ND	ND		ND		ND	ND	ND
2-Butanone		ND	ND		ND		ND	ND	ND
Chlorobenzene		ND	ND		ND		ND	ND	ND
Carbon Disulfide		ND	6.0		ND		ND	4.3 J	42.0
Carbon Tetrachloride		ND	ND		ND		ND	ND	ND
Chloroethane		ND	ND		ND		ND	ND	ND
Chloroform		ND	ND		ND		ND	ND	ND
Chloromethane		ND	ND		ND		ND	ND	ND
Dibromochloromethane		ND	ND		ND		ND	ND	ND
1,1-Dichloroethane		ND	ND		ND		ND	ND	ND
1,2-Dichloroethane		ND	ND		ND		ND	ND	ND
1,1-Dichloroethylene		ND	ND		ND		ND	ND	ND
1,2-Dichloroethylene		ND	ND		ND		7.0	ND	ND
1,2-Dichloropropane		ND	ND		ND		ND	ND	ND
cis-1,3-Dichloropropene		ND	ND		ND		ND	ND	ND
trans-1,3-Dichloropropene		ND	ND		ND		ND	ND	ND
Ethyl Benzene		ND	ND		ND		ND	ND	ND
2-Hexanone		ND	ND		ND		ND	ND	ND
Methylene Chloride		ND	9.7 B		ND		ND	5.2 B	15.0 B
4-Methyl-2-Pentanone		ND	ND		ND		ND	ND	ND
Styrene		ND	ND		ND		ND	ND	ND
1,1,2,2-Tetrachloroethane		ND	ND		ND		ND	ND	ND
Tetrachloroethylene		ND	ND		8.0		30.0	33.0	41.0
Toluene		ND	ND		ND		ND	ND	ND
1,1,1-Trichloroethane		ND	ND		ND		ND	ND	2.0 J
1,1,2-Trichloroethane		ND	ND		ND		ND	ND	ND
Trichloroethene		ND	8.0		1.0 J		3.0 J	ND	ND
Vinyl Acetate		ND	ND		ND		ND	ND	ND
Vinyl Chloride		ND	ND		ND		ND	ND	ND
Total Xylenes		ND	ND		ND		ND	ND	ND
Other:									
Unknown (total)		ND	ND		ND		ND	ND	18.0 J

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW1S 1/22/88 ** (ug/l)	IIA(M)MW1SA 2/27/89 (ug/l)	IIA(M)MW2S 1/19/88 (ug/l)	IIA(M)MW2M 1/21/88 * (ug/l)	IIA(M)MW2MA 2/27/89 (ug/l)	IIA(M)MW2B 1/22/88* (ug/l)	IIA(M)MW2BA 3/1/89 (ug/l)	IIA(M)MW3S 1/19/88 (ug/l)	IIA(M)MW3M 1/19/88 (ug/l)
Semi Volatiles:									
Acenaphthene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Acenaphthylene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Anthracene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Benz(a)anthracene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Benzoic Acid	ND	NA	NA	ND	NA	NA	NA	NA	ND
Benzyl Alcohol	ND	NA	NA	ND	NA	NA	NA	NA	ND
Benzo(b)fluoranthene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Benzo(k)fluoranthene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Benzo(g,h,i)perylene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Benzo(a)pyrene	ND	NA	NA	ND	NA	NA	NA	NA	ND
4-Bromophenyl Phenyl Ether	ND	NA	NA	ND	NA	NA	NA	NA	ND
Butyl Benzyl Phthalate	ND	NA	NA	ND	NA	NA	NA	NA	ND
4-Chloroaniline	ND	NA	NA	ND	NA	NA	NA	NA	ND
bis (2-Chloroethoxy) methane	ND	NA	NA	ND	NA	NA	NA	NA	ND
bis (2-Chloroethyl) ether	ND	NA	NA	ND	NA	NA	NA	NA	ND
bis (2-Chloroisopropyl) ether	ND	NA	NA	ND	NA	NA	NA	NA	ND
4-Chloro-3-Methylphenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
(p-chloro-m-cresol)	ND	NA	NA	ND	NA	NA	NA	NA	ND
2-Chloronaphthalene	ND	NA	NA	ND	NA	NA	NA	NA	ND
2-Chlorophenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
4-Chlorophenyl Phenyl Ether	ND	NA	NA	ND	NA	NA	NA	NA	ND
Chrysene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Dibenz(a,h)anthracene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Dibenzofuran	ND	NA	NA	ND	NA	NA	NA	NA	ND
Di-n-Butylphthalate	ND	NA	NA	ND	NA	NA	NA	NA	ND
1,2-Dichlorobenzene	ND	NA	NA	ND	NA	NA	NA	NA	ND
1,3-Dichlorobenzene	ND	NA	NA	ND	NA	NA	NA	NA	ND
1,4-Dichlorobenzene	ND	NA	NA	ND	NA	NA	NA	NA	ND
3,3'-Dichlorobenzidine	ND	NA	NA	ND	NA	NA	NA	NA	ND
2,4-Dichlorophenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
Diethylphthalate	ND	NA	NA	ND	NA	NA	NA	NA	ND
2,4-Dimethylphenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
Dimethyl Phthalate	ND	NA	NA	ND	NA	NA	NA	NA	ND
4,6-Dinitro-2-Methyl Phenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
2,4-Dinitrophenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
2,4-Dinitrotoluene	ND	NA	NA	ND	NA	NA	NA	NA	ND
2,6-Dinitrotoluene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Di-n-Octyl Phthalate	ND	NA	NA	ND	NA	NA	NA	NA	ND
bis (2-ethylhexyl) phthalate	ND	NA	NA	ND	NA	NA	NA	NA	110.0 B
Fluoranthene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Fluorene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Hexachlorobenzene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Hexachlorobutadiene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Hexachlorocyclopentadiene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Hexachloroethane	ND	NA	NA	ND	NA	NA	NA	NA	ND

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW1S 1/22/88 ** (ug/l)	IIA(M)MW1SA 2/27/89 (ug/l)	IIA(M)MW2S 1/19/88 (ug/l)	IIA(M)MW2M 1/21/88 * (ug/l)	IIA(M)MW2MA 2/27/89 (ug/l)	IIA(M)MW2B 1/22/88+ (ug/l)	IIA(M)MW2BA 3/1/89 (ug/l)	IIA(M)MW3S 1/19/88 (ug/l)	IIA(M)MW3M 1/19/88 (ug/l)
Indeno(1,2,3-cd)pyrene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Isophorone	ND	NA	NA	ND	NA	NA	NA	NA	ND
2-Methylnaphthalene	ND	NA	NA	ND	NA	NA	NA	NA	ND
2-Methyl Phenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
4-Methyl Phenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
Naphthalene	ND	NA	NA	ND	NA	NA	NA	NA	ND
2-Nitroaniline	ND	NA	NA	ND	NA	NA	NA	NA	ND
3-Nitroaniline	ND	NA	NA	ND	NA	NA	NA	NA	ND
Nitrobenzene	ND	NA	NA	ND	NA	NA	NA	NA	ND
2-Nitrophenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
4-Nitrophenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
N-Nitroso-Diphenylamine	ND	NA	NA	ND	NA	NA	NA	NA	ND
N-Nitroso-dipropylamine	ND	NA	NA	ND	NA	NA	NA	NA	ND
Pentachlorophenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
Phenanthrene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Phenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
Phenol (total)	ND	NA	NA	ND	NA	NA	NA	NA	ND
Pyrene	ND	NA	NA	ND	NA	NA	NA	NA	ND
1,2,4-Trichlorobenzene	ND	NA	NA	ND	NA	NA	NA	NA	ND
2,4,5-Trichlorophenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
2,4,6-Trichlorophenol	ND	NA	NA	ND	NA	NA	NA	NA	ND
Other:									
Benzene Sulconamide,N-Ethyl -4-Methyl	ND	NA	NA	ND	NA	NA	NA	NA	23.0 J
Unknown (total)	230.0 JB	NA	NA	850.0 J	NA	NA	NA	NA	ND
Unknown Hexene	ND	NA	NA	ND	NA	NA	NA	NA	ND
Unknown Ethane	ND	NA	NA	ND	NA	NA	NA	NA	ND
Unknown Carboxylic Acid	ND	NA	NA	ND	NA	NA	NA	NA	ND
Unknown Amide	ND	NA	NA	ND	NA	NA	NA	NA	33.0 J

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW1S 1/22/88 ++ (ug/l)	IIA(M)MW1SA 2/27/89 (ug/l)	IIA(M)MW2S 1/19/88 (ug/l)	IIA(M)MW2M 1/21/88 + (ug/l)	IIA(M)MW2MA 2/27/89 (ug/l)	IIA(M)MW2B 1/22/88+ (ug/l)	IIA(M)MW2BA 3/1/89 (ug/l)	IIA(M)MW3S 1/19/88 (ug/l)	IIA(M)MW3M 1/19/88 (ug/l)
Inorganics:									
Aluminum	42800 PN	NA	NA	49300.0 PN	NA	NA	NA	NA	82.0 UP
Antimony	50.0 UP	NA	NA	50.0 UP	NA	NA	NA	NA	50.0 UP
Arsenic	3.0 UFN	NA	NA	[3.9] FN	NA	NA	NA	NA	3.0 UF
Barium	520.0 P	NA	NA	780.0 P	NA	NA	NA	NA	100.0 UP
Beryllium	[1.8] P	NA	NA	[1.8] P	NA	NA	NA	NA	0.3 UP
Cadmium	4.0 UP	NA	NA	4.0 UP	NA	NA	NA	NA	4.0 UPN
Calcium	55300 P	NA	NA	722100.0 P	NA	NA	NA	NA	29700.0 F
Chromium	19.0 PN#	NA	NA	48.0 PN#	NA	NA	NA	NA	6.0 UP
Cobalt	63.0 P	NA	NA	82.0 P	NA	NA	NA	NA	29.0 UP
Copper	120.0 P	NA	NA	140.0 P	NA	NA	NA	NA	3.0 UP
Cyanide	10.0 U	NA	NA	10.0 U	NA	NA	NA	NA	10.0 U
Iron	77100 P	NA	NA	61300.0 P	NA	NA	NA	NA	940.0 F
Lead	33.0 SFN#	NA	NA	47.0 SFN#	NA	NA	NA	NA	3.0 UF
Magnesium	35900 P	NA	NA	35000.0 P	NA	NA	NA	NA	8200.0 F
Manganese	22000 PE	NA	NA	1300.0 PE	NA	NA	NA	NA	230.0 UF
Mercury	0.2 UCV	NA	NA	0.2 UCV	NA	NA	NA	NA	0.2 UCVN
Nickel	46.0 P	NA	NA	87.0 P	NA	NA	NA	NA	22.0 UF
Potassium	11300 P	NA	NA	149100.0 P	NA	NA	NA	NA	[4800.0] F
Selenium	15.0 UFN]:5	NA	NA	15.0 UFEN	NA	NA	NA	NA	3.0 UF
Silver	10.0 UPN	NA	NA	10.0 UPN	NA	NA	NA	NA	10.0 UFN
Sodium	15900 P	NA	NA	89900.0 P	NA	NA	NA	NA	33000.0 F
Thallium	2.0 UFN	NA	NA	2.0 UFN	NA	NA	NA	NA	2.0 UF
Vanadium	77.0 P	NA	NA	62.0 P	NA	NA	NA	NA	14.0 UP
Zinc	230.0 P	NA	NA	74.9 P	NA	NA	NA	NA	6.0 UFN

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW1S 1/22/88 ** (ug/l)	IIA(M)MW1SA 2/27/89 (ug/l)	IIA(M)MW2S 1/19/88 (ug/l)	IIA(M)MW2M 1/21/88 + (ug/l)	IIA(M)MW2MA 2/27/89 (ug/l)	IIA(M)MW2B 1/22/88+ (ug/l)	IIA(M)MW2BA 3/1/89 (ug/l)	IIA(M)MW3S 1/19/88 (ug/l)	IIA(M)MW3M 1/19/88 (ug/l)
Pesticides/PCBs:									
Aldrin		ND	NA	ND	NA	NA	NA	NA	ND
AROCLOR-1016		ND	NA	ND	NA	NA	NA	NA	ND
AROCLOR-1221		ND	NA	ND	NA	NA	NA	NA	ND
AROCLOR-1232		ND	NA	ND	NA	NA	NA	NA	ND
AROCLOR-1242		ND	NA	ND	NA	NA	NA	NA	ND
AROCLOR-1248		ND	NA	ND	NA	NA	NA	NA	ND
AROCLOR-1254		ND	NA	ND	NA	NA	NA	NA	ND
AROCLOR-1260		ND	NA	ND	NA	NA	NA	NA	ND
alpha-BHC		ND	NA	ND	NA	NA	NA	NA	ND
beta-BHC		ND	NA	ND	NA	NA	NA	NA	ND
delta-BHC		ND	NA	ND	NA	NA	NA	NA	ND
gamma-BHC (Lindane)		ND	NA	ND	NA	NA	NA	NA	ND
alpha-Chlordane		ND	NA	ND	NA	NA	NA	NA	ND
gamma-Chlordane		ND	NA	ND	NA	NA	NA	NA	ND
4,4'-DDD		ND	NA	ND	NA	NA	NA	NA	ND
4,4'-DDE		ND	NA	ND	NA	NA	NA	NA	ND
4,4'-DDT		ND	NA	ND	NA	NA	NA	NA	ND
Dieldrin		ND	NA	ND	NA	NA	NA	NA	ND
Endrin		ND	NA	ND	NA	NA	NA	NA	ND
Endrin Ketone		ND	NA	ND	NA	NA	NA	NA	ND
Endosulfan I		ND	NA	ND	NA	NA	NA	NA	ND
Endosulfan II		ND	NA	ND	NA	NA	NA	NA	ND
Endosulfan Sulfate		ND	NA	ND	NA	NA	NA	NA	ND
Heptachlor		ND	NA	ND	NA	NA	NA	NA	ND
Heptachlor Epoxide		ND	NA	ND	NA	NA	NA	NA	ND
Methoxychlor		ND	NA	ND	NA	NA	NA	NA	ND
Toxaphene		ND	NA	ND	NA	NA	NA	NA	ND

U - Indicates compound was analyzed for but not detected.
Reported with the instrument detection limits
N - Indicates spike sample recovery is not within control limits.
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
* - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range
+ - Holding time exceeded for volatiles.
M - Indicates duplicate injection results exceeded control limits.
CV - Cold Vapor Technique
E - Indicates a value estimated or not reported due to the presence of interference
S - Indicates a value determined by method of standard addition.
NA - Not analyzed
ND - Not detected
Blank space - Data is invalid
P - Indicates ICP analysis.
F - Indicates furnace analysis.
[] - Indicates sample value is between IDL and CRDL
- Duplicate analysis is not within control limits.
. Selenium was analyzed at a 1:10 dilution

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW4B 1/22/88 ** (ug/l)	IIA(M)MW4BA 3/1/89 (ug/l)	IIA(M)MW5S 1/19/88 (ug/l)	IIA(M)MW5M 1/19/88 (ug/l)	IIA(M)MW6S 1/20/88 + (ug/l)	IIA(M)MW6SA 2/27/89 (ug/l)	IIA(M)MW6M 1/20/88 + (ug/l)	IIA(M)MW6MA 2/28/89 (ug/l)	IIA(M)MW7S 1/19/88 (ug/l)	IIA(M)MW7M 1/19/88 (ug/l)
Volatiles:										
Acetone		ND	30.0 B	ND		ND		ND	18.0 B	13.0 B
Benzene		ND	3.0 J	ND		ND		ND	ND	ND
Bromodichloromethane		ND	ND	ND		ND		ND	ND	ND
Bromoform		ND	ND	ND		ND		ND	ND	ND
Bromomethane		ND	ND	ND		ND		ND	ND	ND
2-Butanone		ND	ND	ND		ND		ND	ND	ND
Chlorobenzene		ND	ND	ND		ND		ND	ND	ND
Carbon Disulfide		ND	ND	10.0		ND		ND	ND	6.0
Carbon Tetrachloride		ND	ND	ND		ND		ND	ND	ND
Chloroethane		ND	ND	ND		ND		ND	ND	ND
Chloroform		ND	ND	ND		ND		ND	ND	1.5 J
Chloromethane		ND	ND	ND		ND		ND	ND	ND
Dibromochloromethane		ND	ND	ND		ND		ND	ND	ND
1,1-Dichloroethane		ND	ND	ND		ND		ND	ND	ND
1,2-Dichloroethane		ND	ND	ND		ND		ND	ND	ND
1,1-Dichloroethylene		ND	ND	ND		ND		ND	ND	ND
1,2-Dichloroethylene		ND	ND	ND		4.0 J		ND	ND	ND
1,2-Dichloropropane		ND	ND	ND		ND		ND	ND	ND
cis-1,3-Dichloropropene		ND	ND	ND		ND		ND	ND	ND
trans-1,3-Dichloropropene		ND	ND	ND		ND		ND	ND	ND
Ethyl Benzene		ND	ND	ND		ND		ND	ND	ND
2-Hexanone		ND	ND	ND		ND		ND	ND	ND
Methylene Chloride		ND	8.9 B	6.5 B		ND		ND	8.9 B	7.0 B
4-Methyl-2-Pentanone		ND	ND	ND		ND		ND	ND	ND
Styrene		ND	ND	ND		ND		ND	ND	ND
1,1,2,2-Tetrachloroethane		ND	ND	ND		ND		ND	ND	ND
Tetrachloroethylene		ND	ND	ND		38.0		33.0	ND	ND
Toluene		ND	ND	ND		ND		ND	ND	ND
1,1,1-Trichloroethane		ND	ND	ND		ND		ND	ND	ND
1,1,2-Trichloroethane		ND	ND	ND		ND		ND	ND	ND
Trichloroethene		ND	ND	ND		2.0 J		2.0 J	ND	ND
Vinyl Acetate		ND	ND	ND		ND		ND	ND	ND
Vinyl Chloride		ND	ND	ND		ND		ND	ND	ND
Total Xylenes		ND	ND	ND		ND		ND	ND	ND
Other:										

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW4B 1/22/88 ** (ug/l)	IIA(M)MW4BA 3/1/89 (ug/l)	IIA(M)MW5S 1/19/88 (ug/l)	IIA(M)MW5M 1/19/88 (ug/l)	IIA(M)MW6S 1/20/88 + (ug/l)	IIA(M)MW6SA 2/27/89 (ug/l)	IIA(M)MW6M 1/20/88 + (ug/l)	IIA(M)MW6MA 2/28/89 (ug/l)	IIA(M)MW7S 1/19/88 (ug/l)	IIA(M)MW7M 1/19/88 (ug/l)
Semi-Volatiles:										
Acenaphthene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Acenaphthylene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Anthracene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Benz(a)anthracene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Benzoic Acid	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Benzyl Alcohol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Benzo(a)pyrene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
4-Bromophenyl Phenyl Ether	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Butyl Benzyl Phthalate	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
4-Chloroaniline	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
bis (2-Chloroethoxy) methane	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
bis (2-Chloroethyl) ether	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
bis (2-Chloroisopropyl) ether	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
4-Chloro-3-Methylphenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
(p-chloro-m-cresol)	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2-Chloronaphthalene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2-Chlorophenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
4-Chlorophenyl Phenyl Ether	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Chrysene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Dibenzofuran	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Di-n-Butylphthalate	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
3,3'-Dichlorobenzidine	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2,4-Dichlorophenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Diethylphthalate	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2,4-Dimethylphenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Dimethyl Phthalate	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
4,6-Dinitro-2-Methyl Phenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2,4-Dinitrophenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Di-n-Octyl Phthalate	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
bis (2-ethylhexyl) phthalate	95.0 B	NA	NA	1100.0 B	NA	NA	36.0 B	ND	190.0 B	ND
Fluoranthene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Fluorene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Hexachlorobenzene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Hexachlorobutadiene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Hexachloroethane	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW4B 1/22/88 +* (ug/l)	IIA(M)MW4BA 3/1/89 (ug/l)	IIA(M)MW5S 1/19/88 (ug/l)	IIA(M)MW5M 1/19/88 (ug/l)	IIA(M)MW6S 1/20/88 + (ug/l)	IIA(M)MW6SA 2/27/89 (ug/l)	IIA(M)MW6M 1/20/88 + (ug/l)	IIA(M)MW6MA 2/28/89 (ug/l)	IIA(M)MW7S 1/19/88 (ug/l)	IIA(M)MW7M 1/19/88 (ug/l)
Indeno(1,2,3-cd)pyrene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Isophorone	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2-Methylnaphthalene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2-Methyl Phenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
4-Methyl Phenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Naphthalene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2-Nitroaniline	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
3-Nitroaniline	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Nitrobenzene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2-Nitrophenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
4-Nitrophenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
N-Nitroso-Diphenylamine	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
N-Nitroso-dipropylamine	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Pentachlorophenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Phenanthrene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Phenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Phenol (total)	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Pyrene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	NA	NA	ND	NA	NA	ND	ND	ND	ND
Other:										

Benzene Sulconamide,N-Ethyl -4-Methyl	ND	NA	NA	44.0 J	NA	NA	ND	ND	ND	ND
Unknown (total)	530.0 JB	NA	NA	ND	NA	NA	38.0 J	ND	ND	18.0 J
Unknown Hexene	17.0 J	NA	NA	ND	NA	NA	ND	ND	ND	ND
Unknown Ethane	12.0 J	NA	NA	ND	NA	NA	ND	ND	ND	ND
Unknown Carboxylic Acid	120.0 J	NA	NA	ND	NA	NA	ND	ND	ND	ND

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW4B 1/22/88 ** (ug/l)	IIA(M)MW4BA 3/1/89 (ug/l)	IIA(M)MW5S 1/19/88 (ug/l)	IIA(M)MW5M 1/19/88 (ug/l)	IIA(M)MW6S 1/20/88 + (ug/l)	IIA(M)MW6SA 2/27/89 (ug/l)	IIA(M)MW6M 1/20/88 + (ug/l)	IIA(M)MW6MA 2/28/89 (ug/l)	IIA(M)MW7S 1/19/88 (ug/l)	IIA(M)MW7M 1/19/88 (ug/l)
Inorganics:										
Aluminum	12400.0 PN	NA	NA	25100.0 P	NA	NA	910.0 PN	NA	7400.0 P	82.0 UP
Antimony	50.0 UP	NA	NA	50.0 UP	NA	NA	50.0 UP	NA	50.0 UP	50.0 UP
Arsenic	3.0 UFN	NA	NA	3.0 UF	NA	NA	3.0 UFN	NA	[4.5]F	3.0 UF
Barium	[140.0] P	NA	NA	440.0 P	NA	NA	100.0 UP	NA	200.0 P	300.0 P
Beryllium	[0.6] P	NA	NA	0.3 UP	NA	NA	0.3 UP	NA	0.3 UP	0.3 UP
Cadmium	4.0 UP	NA	NA	4.0 UPN	NA	NA	4.0 UP	NA	4.0 UPN	4.0 UPN
Calcium	35800.0 P	NA	NA	68800.0 P	NA	NA	51700.0 P	NA	59200.0 P	101000.0 P
Chromium	10.0 UPN*	NA	NA	40.0 P	NA	NA	10.0 UPN*	NA	6.0 UP	6.0 UP
Cobalt	29.0 UP	NA	NA	[30.0] P	NA	NA	29.0 UP	NA	29.0 UP	29.0 UP
Copper	56.0 P	NA	NA	51.0 P	NA	NA	36.0 P	NA	3.0 UP	3.0 UP
Cyanide	10.0 U	NA	NA	10.0 U	NA	NA	10.0 U	NA	10.0 U	10.0 U
Iron	14800.0 P	NA	NA	52600.0 P	NA	NA	2000.0 P	NA	33600.0 P	92.0 UP
Lead	6.5 FN#	NA	NA	16.9 F	NA	NA	3.0 UFN#	NA	11.5 F	3.0 UF
Magnesium	9700.0 P	NA	NA	31300.0 P	NA	NA	14500.0 P	NA	22500.0 P	39900.0 P
Manganese	320.0 PE	NA	NA	2200.0 P	NA	NA	63.0 PE	NA	1100.0 P	900.0 P
Mercury	0.2 UCV	NA	NA	0.2 UCVN	NA	NA	0.2 UCV	NA	0.2 UCVN	0.2 UCVN
Nickel	22.0 UP	NA	NA	22.0 UP	NA	NA	22.0 UP	NA	22.0 UP	22.0 UP
Potassium	7800.0 P	NA	NA	14400.0 P	NA	NA	5300.0 P	NA	4786.0 UP	11100.0 P
Selenium	3.0 UFN	NA	NA	30.0 UF1:10	NA	NA	3.0 UFN	NA	30.0 UF1:10	3.0 UF1:10
Silver	10.0 UPN	NA	NA	10.0 UPN	NA	NA	10.0 UPN	NA	10.0 UPN	10.0 UPN
Sodium	10700.0 P	NA	NA	32400.0 P	NA	NA	44600.0 P	NA	16300.0 P	103700.0 P
Thallium	2.0 UFN	NA	NA	2.0 UF	NA	NA	2.0 UFN	NA	2.0 UF	2.0 UF
Vanadium	14.0 UP	NA	NA	[34.0] P	NA	NA	14.0 UP	NA	14.0 UP	14.0 UP
Zinc	[7.0] P	NA	NA	6.0 UPN	NA	NA	6.0 UP	NA	6.0 UPN	6.0 UPN

Table No. 4-3 (continued)

PARAMETERS	IIA(M)MW4B 1/22/88 +‡ (ug/l)	IIA(M)MW4BA 3/1/89 (ug/l)	IIA(M)MW5S 1/19/88 (ug/l)	IIA(M)MW5M 1/19/88 (ug/l)	IIA(M)MW6S 1/20/88 + (ug/l)	IIA(M)MW6SA 2/27/89 (ug/l)	IIA(M)MW6M 1/20/88 + (ug/l)	IIA(M)MW6MA 2/28/89 (ug/l)	IIA(M)MW7S 1/19/88 (ug/l)	IIA(M)MW7M 1/19/88 (ug/l)
Pesticides/PCBs:										
Aldrin		ND	NA	ND	NA	NA	ND	NA	ND	ND
AROCLOR-1016		ND	NA	ND	NA	NA	ND	NA	ND	ND
AROCLOR-1221		ND	NA	ND	NA	NA	ND	NA	ND	ND
AROCLOR-1232		ND	NA	ND	NA	NA	ND	NA	ND	ND
AROCLOR-1242		ND	NA	ND	NA	NA	ND	NA	ND	ND
AROCLOR-1248		ND	NA	ND	NA	NA	ND	NA	ND	ND
AROCLOR-1254		ND	NA	ND	NA	NA	ND	NA	ND	ND
AROCLOR-1260		ND	NA	ND	NA	NA	ND	NA	ND	ND
alpha-BHC		ND	NA	ND	NA	NA	ND	NA	ND	ND
beta-BHC		ND	NA	ND	NA	NA	ND	NA	ND	ND
delta-BHC		ND	NA	ND	NA	NA	ND	NA	ND	ND
gamma-BHC (Lindane)		ND	NA	ND	NA	NA	ND	NA	ND	ND
alpha-Chlordane		ND	NA	ND	NA	NA	ND	NA	ND	ND
gamma-Chlordane		ND	NA	ND	NA	NA	ND	NA	ND	ND
4,4'-DDD		ND	NA	ND	NA	NA	ND	NA	ND	ND
4,4'-DDE		ND	NA	ND	NA	NA	ND	NA	ND	ND
4,4'-DDT		ND	NA	ND	NA	NA	ND	NA	ND	ND
Dieldrin		ND	NA	ND	NA	NA	ND	NA	ND	ND
Endrin		ND	NA	ND	NA	NA	ND	NA	ND	ND
Endrin Ketone		ND	NA	ND	NA	NA	ND	NA	ND	ND
Endosulfan I		ND	NA	ND	NA	NA	ND	NA	ND	ND
Endosulfan II		ND	NA	ND	NA	NA	ND	NA	ND	ND
Endosulfan Sulfate		ND	NA	ND	NA	NA	ND	NA	ND	ND
Heptachlor		ND	NA	ND	NA	NA	ND	NA	ND	ND
Heptachlor Epoxide		ND	NA	ND	NA	NA	ND	NA	ND	ND
Methoxychlor		ND	NA	ND	NA	NA	ND	NA	ND	ND
Toxaphene		ND	NA	ND	NA	NA	ND	NA	ND	ND

U - Indicates compound was analyzed for but not detected.
Reported with the instrument detection limits
N - Indicates spike sample recovery is not within control limits.
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
‡ - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range
+ - Holding time exceeded for volatiles.
M - Indicates duplicate injection results exceeded control limits.
CV - Cold Vapor Technique
E - Indicates a value estimated or not reported due to the presence
of interference
S - Indicates a value determined by method of standard addition.
NA - Not analyzed
ND - Not detected
Blank space - Data is invalid
P - Indicates ICP analysis.
F - Indicates furnace analysis.
[] - Indicates sample value is between IDL and CRDL
- Duplicate analysis is not within control limits.
Selenium was analyzed at a 1:10 dilution

Table No. 4-3 (continued)

PARAMETERS	Field Blank 1/19/88 (ug/l)	Trip Blank 1/19/88 (ug/l)	Field Blank 1/21/88 + (ug/l)	Trip Blank 1/21/88 + (ug/l)	Field Blank 1/22/88 + (ug/l)	Trip Blank 1/22/88 + (ug/l)
Volatiles:						
Acetone	21.0 B	42.0 B				
Benzene	1.0 J	ND				
Bromodichloromethane	ND	ND				
Bromoform	ND	ND				
Bromomethane	ND	ND				
2-Butanone	ND	ND				
Chlorobenzene	ND	ND				
Carbon Disulfide	18.0	8.6				
Carbon Tetrachloride	ND	ND				
Chloroethane	ND	ND				
Chloroform	ND	ND				
Chloromethane	ND	ND				
Dibromochloromethane	ND	ND				
1,1-Dichloroethane	ND	ND				
1,2-Dichloroethane	ND	ND				
1,1-Dichloroethylene	ND	ND				
1,2-Dichloroethylene	ND	ND				
1,2-Dichloropropane	ND	ND				
cis-1,3-Dichloropropene	ND	ND				
trans-1,3-Dichloropropene	ND	ND				
Ethyl Benzene	ND	ND				
2-Hexanone	ND	ND				
Methylene Chloride	8.1 B	4.6 JB				
4-Methyl-2-Pentanone	ND	ND				
Styrene	ND	ND				
1,1,2,2-Tetrachloroethane	ND	ND				
Tetrachloroethylene	ND	ND				
Toluene	ND	ND				
1,1,1-Trichloroethane	ND	ND				
1,1,2-Trichloroethane	ND	ND				
Trichloroethene	ND	ND				
Vinyl Acetate	ND	ND				
Vinyl Chloride	ND	ND				
Total Xylenes	ND	ND				
Other:						

Table No. 4-3 (continued)

PARAMETERS	Field Blank 1/19/88 (ug/l)	Trip Blank 1/19/88 (ug/l)	Field Blank 1/21/88 + (ug/l)	Trip Blank 1/21/88 + (ug/l)	Field Blank 1/22/88 + (ug/l)	Trip Blank 1/22/88 + (ug/l)
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methyl Phenol	NA	NA	NA	NA	NA	NA
4-Methyl Phenol	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA
N-Nitroso-Diphenylamine	NA	NA	NA	NA	NA	NA
N-Nitroso-dipropylamine	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA
Phenol (total)	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA

Other:

Table No. 4-3 (continued)

PARAMETERS	Field Blank 1/19/88 (ug/l)	Trip Blank 1/19/88 (ug/l)	Field Blank 1/21/88 + (ug/l)	Trip Blank 1/21/88 + (ug/l)	Field Blank 1/22/88 + (ug/l)	Trip Blank 1/22/88 + (ug/l)
Semi-Volatiles:						
Acenaphthene	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA
Benz(a)anthracene	NA	NA	NA	NA	NA	NA
Benzoic Acid	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA
bis (2-Chloroethoxy) methane	NA	NA	NA	NA	NA	NA
bis (2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA
bis (2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	NA	NA	NA	NA	NA	NA
(p-chloro-m-cresol)	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Di-n-Butylphthalate	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA
Diethylphthalate	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methyl Phenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
Di-n-Octyl Phthalate	NA	NA	NA	NA	NA	NA
bis (2-ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA

Table No. 4-3 (continued)

PARAMETERS	Field Blank 1/19/88 (ug/l)	Trip Blank 1/19/88 (ug/l)	Field Blank 1/21/88 + (ug/l)	Trip Blank 1/21/88 + (ug/l)	Field Blank 1/22/88 + (ug/l)	Trip Blank 1/22/88 + (ug/l)
Inorganics:						
Aluminum	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA

Table No. 4-3 (continued)

PARAMETERS	Field Blank 1/19/88 (ug/l)	Trip Blank 1/19/88 (ug/l)	Field Blank 1/21/88 + (ug/l)	Trip Blank 1/21/88 + (ug/l)	Field Blank 1/22/88 + (ug/l)	Trip Blank 1/22/88 + (ug/l)
Pesticides/PCBs:						
Aldrin	NA	NA	NA	NA	NA	NA
AROCLOR-1016	NA	NA	NA	NA	NA	NA
AROCLOR-1221	NA	NA	NA	NA	NA	NA
AROCLOR-1232	NA	NA	NA	NA	NA	NA
AROCLOR-1242	NA	NA	NA	NA	NA	NA
AROCLOR-1248	NA	NA	NA	NA	NA	NA
AROCLOR-1254	NA	NA	NA	NA	NA	NA
AROCLOR-1260	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA
alpha-Chlordane	NA	NA	NA	NA	NA	NA
gamma-Chlordane	NA	NA	NA	NA	NA	NA
4,4'-DDD	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA
Endrin Ketone	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA

U - Indicates compound was analyzed for but not detected.
Reported with the instrument detection limits.
N - Indicates spike sample recovery is not within control limits.
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
* - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range
+ - Holding time exceeded for volatiles.
M - Indicates duplicate injection results exceeded control limits.
CV - Cold Vapor Technique
E - Indicates a value estimated or not reported due to the presence of interference
S - Indicates a value determined by method of standard addition.
NA - Not analyzed
ND - Not detected
Blank space - Data is invalid
P - Indicates ICP analysis.
F - Indicates furnace analysis.
[] - Indicates sample value is between IDL and CRDL

Table No. 4-3 (continued)

PARAMETERS	Field Blank 2/27/89 (ug/l)	Trip Blank 2/27/89 (ug/l)	Field Blank 2/28/89 (ug/l)	Field Blank 3/1/89 (ug/l)	Trip Blank 3/1/89 (ug/l)
Volatiles:					
Acetone	9.0 J	ND	43.0	7.0 J	ND
Benzene	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND	ND
1,2-Dichloroethylene	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND
Ethyl Benzene	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND
Methylene Chloride	ND	2.0 J	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND
Trichloroethene	4.0 J	ND	ND	ND	2.0 J
Vinyl Acetate	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND
Other:					

Table No. 4-5 (continued)

PARAMETERS	Field Blank 2/27/89 (ug/l)	Trip Blank 2/27/89 (ug/l)	Field Blank 2/28/89 (ug/l)	Field Blank 3/1/89 (ug/l)	Trip Blank 3/1/89 (ug/l)
Semi-Volatiles:					
Acenaphthene	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA
Benz(a)anthracene	NA	NA	NA	NA	NA
Benzoic Acid	NA	NA	NA	NA	NA
Benzyl Alcohol	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA
bis (2-Chloroethoxy) methane	NA	NA	NA	NA	NA
bis (2-Chloroethyl) ether	NA	NA	NA	NA	NA
bis (2-Chloroisopropyl) ether	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol (p-chloro-m-cresol)	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA
Di-n-Butylphthalate	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA
Diethylphthalate	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methyl Phenol	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA
Di-n-Octyl Phthalate	NA	NA	NA	NA	NA
bis (2-ethylhexyl) phthalate	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA

Table No. 4-3 (continued)

PARAMETERS	Field Blank 2/27/89 (ug/l)	Trip Blank 2/27/89 (ug/l)	Field Blank 2/28/89 (ug/l)	Field Blank 3/1/89 (ug/l)	Trip Blank 3/1/89 (ug/l)
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA
2-Methyl Phenol	NA	NA	NA	NA	NA
4-Methyl Phenol	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA
N-Nitroso-Diphenylamine	NA	NA	NA	NA	NA
N-Nitroso-dipropylamine	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA
Phenol (total)	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA

Other:

Table No. 4-3 (continued)

PARAMETERS	Field Blank 2/27/89 (ug/l)	Trip Blank 2/27/89 (ug/l)	Field Blank 2/28/89 (ug/l)	Field Blank 3/1/89 (ug/l)	Trip Blank 3/1/89 (ug/l)
Inorganics:					
Aluminum	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA

Table No. 4-3 (continued)

PARAMETERS	Field Blank 2/27/89 (ug/l)	Trip Blank 2/27/89 (ug/l)	Field Blank 2/28/89 (ug/l)	Field Blank 3/1/89 (ug/l)	Trip Blank 3/1/89 (ug/l)
Pesticides/PCBs:					
Aldrin	ND	NA	NA	ND	NA
AROCLOR-1016	ND	NA	NA	ND	NA
AROCLOR-1221	ND	NA	NA	ND	NA
AROCLOR-1232	ND	NA	NA	ND	NA
AROCLOR-1242	ND	NA	NA	ND	NA
AROCLOR-1248	ND	NA	NA	ND	NA
AROCLOR-1254	ND	NA	NA	ND	NA
AROCLOR-1260	ND	NA	NA	ND	NA
alpha-BHC	ND	NA	NA	ND	NA
beta-BHC	ND	NA	NA	ND	NA
delta-BHC	ND	NA	NA	ND	NA
gamma-BHC (Lindane)	ND	NA	NA	ND	NA
alpha-Chlordane	ND	NA	NA	ND	NA
gamma-Chlordane	ND	NA	NA	ND	NA
4,4'-DDD	ND	NA	NA	ND	NA
4,4'-DDE	ND	NA	NA	ND	NA
4,4'-DDT	ND	NA	NA	ND	NA
Dieldrin	ND	NA	NA	ND	NA
Endrin	ND	NA	NA	ND	NA
Endrin Ketone	ND	NA	NA	ND	NA
Endosulfan I	ND	NA	NA	ND	NA
Endosulfan II	ND	NA	NA	ND	NA
Endosulfan Sulfate	ND	NA	NA	ND	NA
Heptachlor	ND	NA	NA	ND	NA
Heptachlor Epoxide	ND	NA	NA	ND	NA
Methoxychlor	ND	NA	NA	ND	NA
Toxaphene	ND	NA	NA	ND	NA

U - Indicates compound was analyzed for but not detected.
Reported with the instrument detection limits.
N - Indicates spike sample recovery is not within control limits.
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
† - Pesticide, PCB's - The retention time window for Endrin was outside the allowable range
‡ - Holding time exceeded for volatiles.
M - Indicates duplicate injection results exceeded control limits.
CV - Cold Vapor Technique
E - Indicates a value estimated or not reported due to the presence of interference
S - Indicates a value determined by method of standard addition.
NA - Not analyzed
ND - Not detected
Blank space - Data is invalid
P - Indicates ICP analysis.
F - Indicates furnace analysis.
[] - Indicates sample value is between IDL and CRDL

4.3.1 Monitoring Well MW-4 (MW-4B [39'])

The location for monitoring well MW-4B was chosen to provide soil and ground water quality information immediately adjacent to a suspected source of contamination. Bedrock at this location was encountered at a depth of four feet below grade. Since evidence of saturation did not exist in the overburden soils at this location, a well was not constructed in this strata. Alternatively, a PVC casing was grouted in the bedrock and 30 feet of rock core was removed from the boring. A significant water bearing fracture was bisected in the third core run between 29 and 39 feet below ground surface.

4.3.1.1 Organic Sampling Results

The organic compounds detected in sample IIA(M)MW-4B are listed below. Analytes of concern were not detected in this sample. (Please note that the initial sample failed QA/QC requirements for pesticides/PCBs and volatiles. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Bis (2-ethylhexyl) phthalate	95.0 B
Unknown carboxylic acid	120.0 J
Unknown hexene	17.0 J
Unknown ethane	12.0 J
Unknown (total)	530.0 JB

"J" indicates estimated value.
"B" indicates compound found in method blank.

During the Phase IIA sampling program, methylene chloride and acetone, as well as carbon disulfide were commonly found in trip blanks and fields blanks, and are laboratory contaminants. Benzene was also found in a low estimated level (1.0 ug/l in a field blank).

As noted above, B indicates that the compound was found in the laboratory method blank, and J is an estimated value, since the concentration is beyond (either higher or lower) the limits of the calibration curve.

4.3.1.2 Inorganic Sampling Results

The following inorganic constituents were found in sample IIA(M)MW-4B:

Constituent	Concentration (ug/l
Aluminum	12,400.0 N
Barium	[140.0]
Beryllium	[0.6]
Calcium	35,800.0
Copper	56.0
Iron	14,800.0
Lead	6.5 N#
Magnesium	9,700.0
Manganese	320.0 E
Potassium	7,800.0
Sodium	10,700.0
Zinc	[7.0]

"N" indicates spike sample recovery was not within control limits.
"#" indicates duplicate analysis was not within control limits.
"E" indicates this sample value was estimated due to interference.
"[ ]" indicates the reported value is between the CRDL and IDL.

4.3.2 Monitoring Well Cluster MW-2 (MW-2S [18'], MW-2M [47'] and MW-2B [90'])

In 1985, three shallow monitoring wells (MW-1S, MW-2S and MW-3S) were constructed in the parking lot of the Hunting Ridge Mall Site as part of a limited ground water investigation. This program was undertaken by the owner of the Hunting Ridge Mall, in cooperation with the Westchester County Department of Health (WCDH) and the New York State Department of Environmental Conservation (NYSDEC). Of the three existing shallow (water table) monitoring wells, MW-2 and MW-3 were selected as the locations to install complimentary monitoring wells because they had the highest concentrations of contamination indicated from previous sampling. Accordingly, a mid-depth/interface well and a bedrock monitoring well were installed adjacent to the existing shallow well at MW-2. These wells provided information pertaining to potential vertical migration of contaminated ground water at the site, as well as horizontal migration to areas downgradient of the Hunting Ridge Mall property boundary.

4.3.2.1 Organic Sampling Results

The analytical results for sample IIA(M)MW-2S is provided below. The only analyte of concern detected in this well was trichloroethene.

Compound	Concentration (ug/l)
Trichloroethene	8.6
Acetone	45.0 B
Methylene chloride	9.7 B
Carbon disulfide	6.0

"J" indicates estimated value.
"B" indicates compound found in method blank.

The organic contaminants detected in sample IIA(M)MW-2M obtained from the mid-depth well at the MW-2 cluster, of which tetrachloroethene and trichloroethene are analytes of concern, are the following: (Please note that the initial sample failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Tetrachloroethene	8.0
Trichloroethene	1.0 J
Acetone	12.0
Unknown (total)	850.0 J

"J" indicates estimated value.

The analytical results for sample IIA(M)MW-2B contained the following compounds, of which tetrachloroethene, trichloroethene and 1,2-dichloroethene (total) are analytes of concern. (Please note that the initial sample failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Tetrachloroethene	30.0
Trichloroethene	3.0 J
1,2-Dichloroethene (total)	7.0

"J" indicates estimated value.

4.3.2.2 Inorganic Sampling Results

Of the wells included in the MW-2 monitoring well cluster, inorganic analyses were performed only on the sample from monitoring well MW-2M. The analytical results for sample IIA(M)MW-2M included the following inorganic constituents:

Constituent	Concentration (ug/l
Aluminum	49,300.0 N
Arsenic	[3.9] N
Barium	780.0
Beryllium	[1.8]
Calcium	722,100.0
Chromium	48.0 N#
Cobalt	82.0
Cooper	140.0
Iron	61,300.0
Lead	47.0
Magnesium	35,000.0
Manganese	1,300.0 E
Nickel	87.0
Potassium	149,100.0
Sodium	89,900.0
Vanadium	62.0
Zinc	74.0

"N" indicates spike sample recovery was not within control limits.
"#" indicates duplicate analysis was not within control limits.
"E" indicates this sample value was estimated due to interference.
"[ ]" indicates the reported value is between the CRDL and IDL.

4.3.3 Monitoring Well Cluster MW-3 (MW-3S [19'] and MW-3M [73'])

MW-3S is an existing shallow overburden/water table monitoring well. Adjacent to MW-3S, a mid-depth well (MW-3M) was constructed as part of this Remedial Investigation. These two wells provide information pertaining to potential vertical migration of contaminated ground water, as well as horizontal migration to areas downgradient of the Hunting Ridge Mall property boundary.

4.3.3.1 Organic Sampling Results

The analytical results for sample IIA(M)MW-3S were the following, of which tetrachloroethene is an analyte of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	33.0
Acetone	9.8 JB
Methylene chloride	5.2 B
Carbon disulfide	4.3 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

The analytical results for sample IIA(M)MW-3M contained the compounds listed below. Tetrachloroethene, 1,1,1-trichloroethane and benzene are analytes of concern. The source of the amide and benzene subulconamide, N-ethyl-4-methyl is unknown.

Compound	Concentration (ug/l)
Tetrachloroethene	41.0
1,1,1-Trichloroethane	2.0 J
Benzene	6.0
Bis (2-ethylexyl) phthalate	110.0 B
Acetone	60.0 B
Methylene chloride	15.0 B
Carbon disulfide	42.0
Unknown amide	33.0 J
Benzene sulconamide, N-ethyl-4-methyl	23.0 J
Unknown (total)	18.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.3.3.2 Inorganic Sampling Results

Of the wells included in the MW-3 monitoring well cluster, inorganic analyses were performed only on the sample from MW-3M. The following inorganic constituents were found in sample IIA(M)MW-3M:

Constituent	Concentration (ug/l)
Calcium	29,700.0
Iron	940.0
Magnesium	8,200.0
Potassium	[4,800.0]
Sodium	33,000.0

"[ ]" indicates the reported value is between the CRDL and IDL.

4.3.4 Monitoring Well MW-1 (MW-1S [33'])

MW-1S is an existing shallow (water table) monitoring well previously installed by the Mall owner.

4.3.4.1 Organic Sampling Results

No organic chemical contamination was detected in sample IIA(M)MW-1S, however, an unknown compound was found. (Please note that the initial sample failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Unknown (total)	230.0 JB

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.3.4.2 Inorganic Sampling Results

The following inorganic constituents were found in sample IIA(M)MW-1S:

Constituent	Concentration (ug/l
Aluminum	42,800.0 N
Barium	520.0
Beryllium	[1.8]
Calcium	55,300.0
Chromium	19.0 N#
Cobalt	63.0
Copper	120.0
Iron	77,100.0
Lead	33.0 SN#
Magnesium	35,900.0
Manganese	22,000.0 E
Nickel	46.0
Potassium	11,300.0
Sodium	15,900.0
Vanadium	77.0
Zinc	230.0

"S" indicates a value was determined by MSA.
"N" indicates spike sample recovery was not within control limits.
"#" indicates duplicate analysis was not within control limits.
"E" indicates this sample value was estimated due to interference.
"[ ]" indicates the reported value is between the CRDL and IDL.

4.3.5 Monitoring Well Cluster MW-5 (MW-5S [43'] and MW-5M [67'])

Monitoring well cluster MW-5 was constructed on the Ponds Development Property just south of Route 22 and downgradient of the Hunting Ridge Mall. These monitoring wells provided ground water quality data in the unconsolidated stratified drift located immediately south of the Mall migrating towards the Mianus River.

4.3.5.1 Organic Sampling Results

Organic chemical contaminants detected in sample IIA(M)MW-5S are the following, of which benzene is an analyte of concern.

Compound	Concentration (ug/l)
Benzene	3.0 J
Acetone	30.0 B
Methylene chloride	8.9 B

"J" indicates estimated value.
"B" indicates compound found in method blank.

The analytical results for sample IIA(M)MW-5M contained the compounds listed below. Analytes of concern were not detected in this sample.

Compound	Concentration (ug/l)
Methylene chloride	6.5 B
Carbon disulfide	10.0
Bis (2-ethylexyl) phthalate	1,100.0 B
Benzene sulconamide,n-ethyl-4-methyl	44.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.3.5.2 Inorganic Sampling Results

Of the wells included in the MW-5 monitoring well cluster, inorganic analyses were performed only on the sample from MW-5M. The following inorganic constituents were found in sample IIA(M)MW-5M:

Constituent	Concentration (ug/l)
Aluminum	25,100.0
Barium	440.0

Calcium	68,800.0
Chromium	40.0
Cobalt	[30.0]
Copper	51.0
Iron	52,600.0
Lead	16.9
Magnesium	31,300.0
Manganese	2,200.0
Potassium	14,400.0
Sodium	32,400.0
Vanadium	[34.0]

"[ ]" indicates the reported value is between the CRDL and IDL.

4.3.6 Monitoring Well Cluster MW-6 (MW-6S [44'] and MW-6M [58'])

Monitoring well cluster MW-6 was also constructed on the Ponds Development Property just south of Route 22 and downgradient of the Hunting Ridge Mall. These monitoring wells provide additional ground water quality data in the unconsolidated stratified drift located immediately southeast of the Mall site migrating towards the Mianus River.

4.3.6.1 Organic Sampling Results

The analytical results for sample IIA(M)MW-6S contained the following compounds, of which tetrachloroethene, trichloroethene and 1,2-dichloroethene (total) are all analytes of concern. (Please note that the initial sample failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed, and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Tetrachloroethene	38.0
Trichloroethene	2.0 J
1,2-Dichloroethene (total)	4.0 J

"J" indicates estimated value.

The analytical results of sample IIA(M)MW-6M contained the following compounds, of which tetrachloroethene and trichloroethene are again analytes of concern. (Please note that the initial sample failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed, and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Tetrachloroethene	33.0
Trichloroethene	2.0 J
Bis (2-ethylhexyl) phthalate	36.0 B
Unknown (total)	38.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.3.6.2 Inorganic Sampling Results

Of the wells included in the MW-6 monitoring well cluster, inorganic analyses were performed only on the sample from MW-6M. The following inorganic constituents were detected in sample IIA(M)MW-6M:

Constituent	Concentration (ug/l)
Aluminum	910.0 N
Calcium	51,700.0
Copper	36.0
Iron	2,000.0
Magnesium	14,500.0
Manganese	63.0 E
Potassium	5,300.0
Sodium	44,600.0

"N" indicates spike sample recovery was not within control limits.
"E" indicates this sample value was estimated due to interference.

4.3.7 Monitoring Well Cluster MW-7 (MW-7S [20.5'] and MW-7M [72'])

Monitoring well cluster MW-7 was constructed on Lake Avenue adjacent to the stream bed that receives stormwater drainage from the Hunting Ridge Mall. Monitoring at this location provides ground water quality data in the drainage area east of the Mall and assists in determining if this area is a secondary source of contamination due to past discharges to the drainage system of the Mall.

4.3.7.1 Organic Sampling Results

The analytical results for sample IIA(M)MW-7S contained the compounds listed below. Analytes of concern were not detected in this sample.

Compound	Concentration (ug/l)
Acetone	18.0 B
Methylene chloride	8.9 B
Bis (2-ethylhexyl) phthalate	190.0 B

"B" indicates compound found in method blank.

The analytical results for sample IIA(M)MW-7M contained the following compounds, and again the analytes of concern were not detected.

Compound	Concentration (ug/l)
Acetone	13.0 B
Methylene chloride	7.0 B
Carbon disulfide	6.0
Chloroform	1.5 J
Unknown (total)	18.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.3.7.2 Inorganic Sampling Results

The analytical results for sample IIA(M)MW-7S contained the following inorganic constituents:

Constituent	Concentration (ug/l)
Aluminum	7,400.0
Arsenic	[4.5]
Barium	200.0
Calcium	59,200.0
Iron	33,600.0
Lead	11.5
Magnesium	22,500.0
Manganese	1,100.0
Sodium	16,300.0

"[ ]" indicates the reported value is between the CRDL and IDL.

The analytical results for sample IIA(M)MW-7M contained the following inorganic constituents:

Constituent	Concentration (ug/l)
Barium	300.0
Calcium	101,000.0
Magnesium	39,900.0
Manganese	900.0
Potassium	11,100.0
Sodium	103,700.0

4.4 Description of the Phase IIB Sampling Program

This section reviews the specific components and associated activities of the Phase IIB sampling program. The data collected from the Phase IA and Phase IB (source/surficial) sampling program, as well as the initial Phase IIA (subsurface) sampling program, assisted in determining the design of the Phase IIB sampling program.

Similar to Phase IIA, the objective of the Phase IIB well drilling program was to collect and analyze subsurface data from the Hunting Ridge Mall Site and the surrounding area. As a means of developing this information, soil borings and monitoring wells were installed. Also similar to the Phase IIA sampling program, soil samples were obtained from the borehole and screened in the field by utilizing an organic vapor analyzer (OVA). After screening with the analyzer, a number of soil samples were selected for chemical analysis at either the New York State Department of Environmental Conservation (NYSDEC) laboratory in Saratoga, or an infield Gas Chromatograph (GC) provided through NYSDEC and located in Spring Valley. Once the monitoring wells were constructed, ground water samples were collected and forwarded to a NYSDEC certified laboratory for analysis. The analytical data generated as part of the Phase IIA sampling program, complimented by the data resulting from the Phase IA and Phase IB sampling programs made it possible to identify on an initial basis, the location of the sources of contamination, and to assess the surficial transport and subsurface migration pathway of contaminants through the study area. This data assisted in making decisions on the specific sampling locations for the Phase IIB component of the Remedial Investigation which were to confirm the extent and travel of ground water contamination.

The following activities were undertaken prior to and during the Phase IIB program:

- o In addition to the pertinent, available literature, and technical reports and data reviewed in preparation for the Phase IIA program (described in Section 4.2), the following report was reviewed:

  - Dvirka and Bartilucci Consulting Engineers, "Remedial Investigation Interim Report Phase IIA Sampling Program (Hunting Ridge Mall), March 1988."

- o Aerial photographs of the study area were again reviewed for information on land use patterns, potential sources of contamination, local topography and drainage patterns, as well as aerial topographic contour maps to better understand the surficial and subsurface drainage patterns in the area.

- o Data generated from the seismic survey conducted during Phase IA of this investigation was also again reviewed and incorporated in to the design of the Phase IIB sampling program.

- o Ten monitoring wells were constructed at six locations.

- o All monitoring wells constructed as part of the Phase IIB sampling program, as well as the three existing ground water monitoring wells previously installed by the Mall owner and the ten wells installed in Phase IIA were sampled. The Phase IIB wells were also surveyed. Ground water level readings were obtained from all wells and recorded. These measurements supplied the necessary data for determining ground water flow direction underlying and in the immediate vicinity of the site.

4.4.1 Selection of Ground Water Monitoring Well Locations

The rationale for the overall selection of monitoring well locations for the Phase IIB drilling program was based on the analytical data generated by prior ground water investigations, the analytical data obtained from the Phase IA, IB and IIA sampling programs, the location of the suspected source(s) of contamination, and the determination that ground water is flowing toward and discharging to the Mianus River.

The well depths for each monitoring well which was constructed in Phase IIB in the Hunting Ridge Mall Study Area is provided below. The locations of the wells are illustrated in Figure No. 4-9.

Well Number	Location	Depth (ft)*
MW-4B**	Directly in back of the Mall building	84.3
MW-6B	Southeast of the Mall on Ponds Development Property	159
MW-8M	Directly south of the hardware store building	33
MW-8B	and east of the Mall	68
MW-9M	Southeast of the Mall and the MW-5 well	71
MW-9B	location on the Ponds Development Property	124.5
MW-10M	Southeast of the Mall and adjacent to	126
MW-10B	Turtle Pond	180
MW-12M	Southeast of the Mall between the MW-5 and MW-6 well locations on the Ponds Development Property	61.2
MW-13M	Southeast of the Mall and the MW-9 and	110
MW-13B	MW-11 well locations on the Ponds Development Property. (These wells are the furthest downgradient ground water monitoring location in the study area.)	154

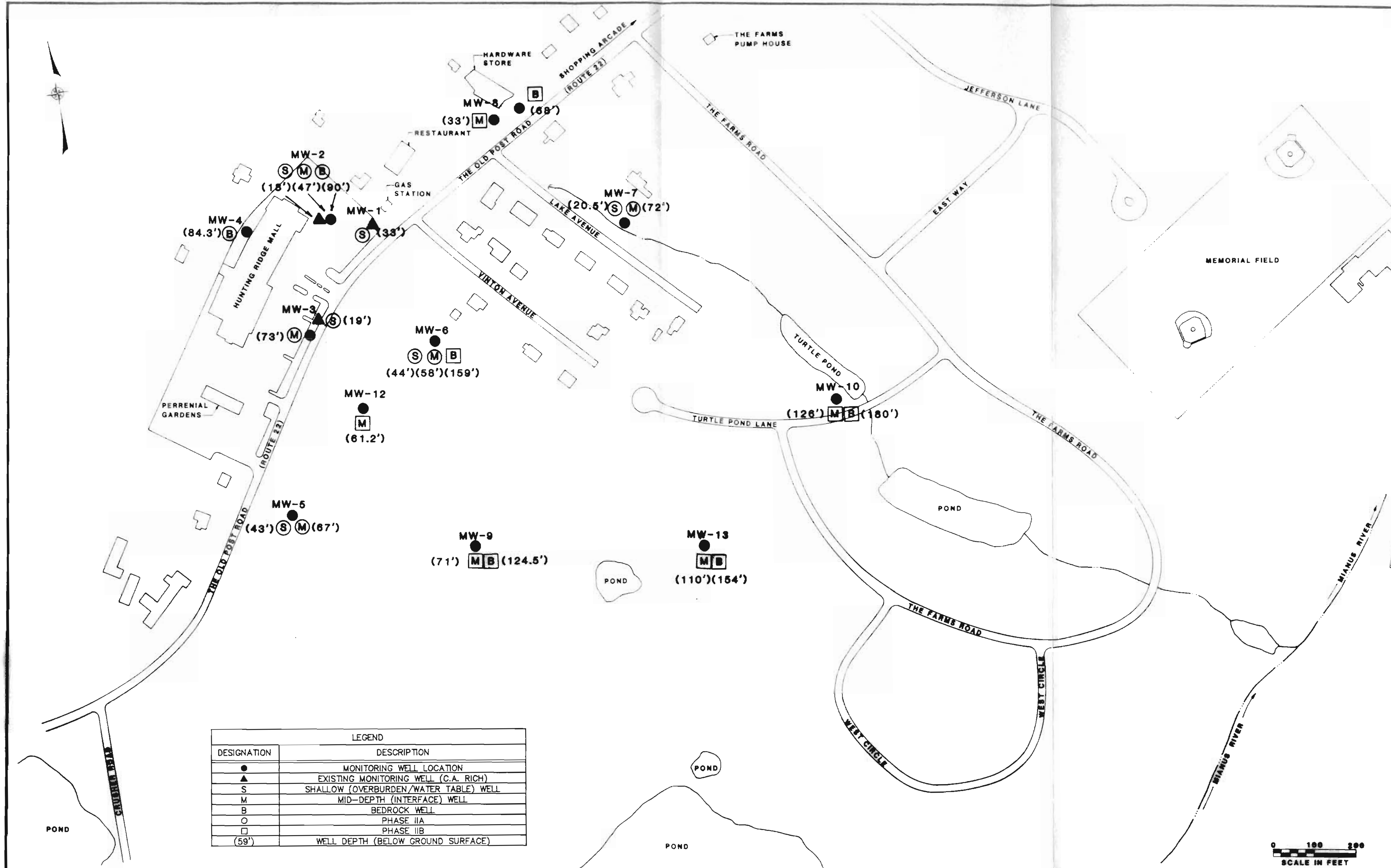
* Depth below ground surface

** MW-4B is not a new boring location, rather the Phase IIA borehole was deepened during Phase IIB from its original depth of 39 feet to 84.3 feet.

Note: MW-#M refers to a mid-depth (overburden/bedrock interface) well

MW-#B refers to a bedrock well

In total, Phase IIB consisted of the construction of five new mid-depth (interface) wells and five bedrock wells. The existing monitoring well MW-4B, which was constructed during the initial Phase IIA sampling program, was deepened during the Phase IIB program.



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION
▲	EXISTING MONITORING WELL (C.A. RICH)
S	SHALLOW (OVERBURDEN/WATER TABLE) WELL
M	MID-DEPTH (INTERFACE) WELL
B	BEDROCK WELL
○	PHASE IIA
□	PHASE IIB
(59')	WELL DEPTH (BELOW GROUND SURFACE)

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DESIGNED BY: CHECKED BY:

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BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
PHASE II B
MONITORING WELL LOCATIONS

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DATE:
SCALE: AS NOTED
FIGURE NO. 4-9

Results from ground water samples collected from MW-4B in the initial phase of sampling revealed that there was no detectable concentrations of the analytes of concern in the shallow bedrock behind the Mall. In consultation with the NYSDEC it was decided to deepen this existing well so as to bisect more fractures in the bedrock and yield water quality more representative of the formation. It was also decided that if ground water obtained from MW-4B did not detect the analytes of concern after it was deepened it would be considered as a suitable upgradient well for the Hunting Ridge Mall Study Area.

The following is a discussion of the rationale incorporated for the placement of the ten Phase IIB ground water monitoring wells in the study area.

- The bedrock well installed at the MW-6 location provided bedrock ground water quality data in an area in which it was previously determined in Phase IIA that ground water contamination exists in the overlying stratified drift deposits. This well assists in determining the interrelationship between the ground water flow (contaminant migration) between the overlying stratified drift deposits and the underlying bedrock.

- The well cluster installed at the MW-8 location provides ground water quality data for the stratified drift deposits and bedrock directly downgradient of the hardware store. These wells assist in verifying whether or not the subsurface disposal system at the hardware store is/was a potential source of contamination due to waste disposal practices. This well cluster is also the furthest subsurface boring in the northeastern portion of the study area. The data obtained contributed to a better understanding of ground water flow direction as well as subsurface lithology in the study area.

- Well cluster MW-9 provides ground water quality data in the stratified drift and bedrock zones which are downgradient of the MW-5 and the MW-6 monitoring well locations. The ground water sampled at the MW-5 location as part of Phase IIA did not detect any of the analytes of concern; however, ground water sampled at the MW-6 location did indicate the presence of volatile organic contaminants. The MW-9 cluster assists in defining the downgradient aerial extent of the ground water contamination underlying the study area.

- The well cluster installed at MW-10 provides ground water quality data in the deep unstratified drift deposits as well as the bedrock downgradient of the MW-6 and the MW-7 monitoring well locations. The ground water samples obtained from the MW-7 location in Phase IIA did not detect any of the analytes of concern. However, the MW-6 location did indicate the presence of volatile organic compounds. The MW-10 location provides definition of the downgradient aerial extent of contamination in the study area. In addition, the MW-10 cluster is located the furthest east and south of all other boring locations within the study area. The MW-10 borings generate important ground water elevations which assisted in determining the direction of ground water flow as well as provided soil characteristic data for establishing the lithology underlying the study area.

- The mid-depth (interface) monitoring well installed at the MW-12 location provides ground water quality data for an area which was suspected of containing significant volatile organic contamination as determined by the soil gas survey conducted by the United States Environmental Protection Agency (USEPA). Obtaining ground water samples at this location also assists in determining the aerial extent and the concentration gradient of contamination in the stratified drift deposits. MW-12 is located between MW-5 (no detection of the analytes of concern) and MW-6 (where analytes of concern were detected).

- The well cluster installed at the MW-13 location provides data on the ground water quality within the deep stratified drift deposits and bedrock at the furthest southeast and furthest downgradient location within the study area. The MW-13 location is directly downgradient of MW-6 in which the presence of organic contamination was detected in Phase IIA. MW-13 ground water quality data assists in defining the downgradient migration of the contaminant plume as well as mapping the soil and rock types.

4.4.2 Analytical Parameters

For all Phase IIB samples taken, laboratory analysis was conducted to determine the presence of volatile organic chemicals including the analytes of concern (tetrachloroethene, trichloroethene, cis/trans-1,2-dichloroethene, vinyl chloride, 1,1,1-trichloroethane, benzene, toluene and xylene).

4.4.3 Location of Background Ground Water Monitoring Well

The Phase II well drilling program was designed to confirm data obtained in the past, as well as to better define the suspected source and extent of contamination in order to develop an appropriate remedial action. As a result of completion of the Phase IIA program, ground water flow patterns were determined in the water table zone as well as at the overburden/bedrock interface on a preliminary basis.

Part of the Phase II well drilling program included the construction of an upgradient monitoring well at the Hunting Ridge Mall Site. The purpose of an upgradient well is to provide representative ground water samples as a control in the program to document the ambient quality of ground water that is migrating into the study area. This will provide better definition of the suspected source and degree of contamination in the study area. A review of the Phase IIA ground water quality data indicated that the MW-4 monitoring well location did not contain detectable concentrations of the analytes of concern in the shallow bedrock.

In consultation with NYSDEC and as discussed in Section 4.4.1, it was decided to deepen the existing MW-4 borehole during the Phase IIB drilling program. If the ground water quality data for this location did not detect concentrations of the analytes of concern after being deepened, it would then be considered suitable as the upgradient well at the Hunting Ridge Mall Study Area. After receipt of the results, it was deemed suitable for this purpose.

4.5 Analytical Results of the Phase IIB Sampling Program

The purpose of this section is to present the analytical results of the ground water samples collected during the Phase IIB component of the sampling program.

During the Phase IIB sampling program, ground water samples were collected from all monitoring wells within the study area. This included the three existing wells installed by the owner of the Mall, the ten monitoring wells installed during Phase IIA of the Remedial Investigation as well as the ten Phase IIB monitoring wells.

The resampling of the existing wells provided data which support the results of data obtained during previous sampling events. Resampling not only provided quality assurance with the integrity of the previous data but also allowed the identification trends in the data.

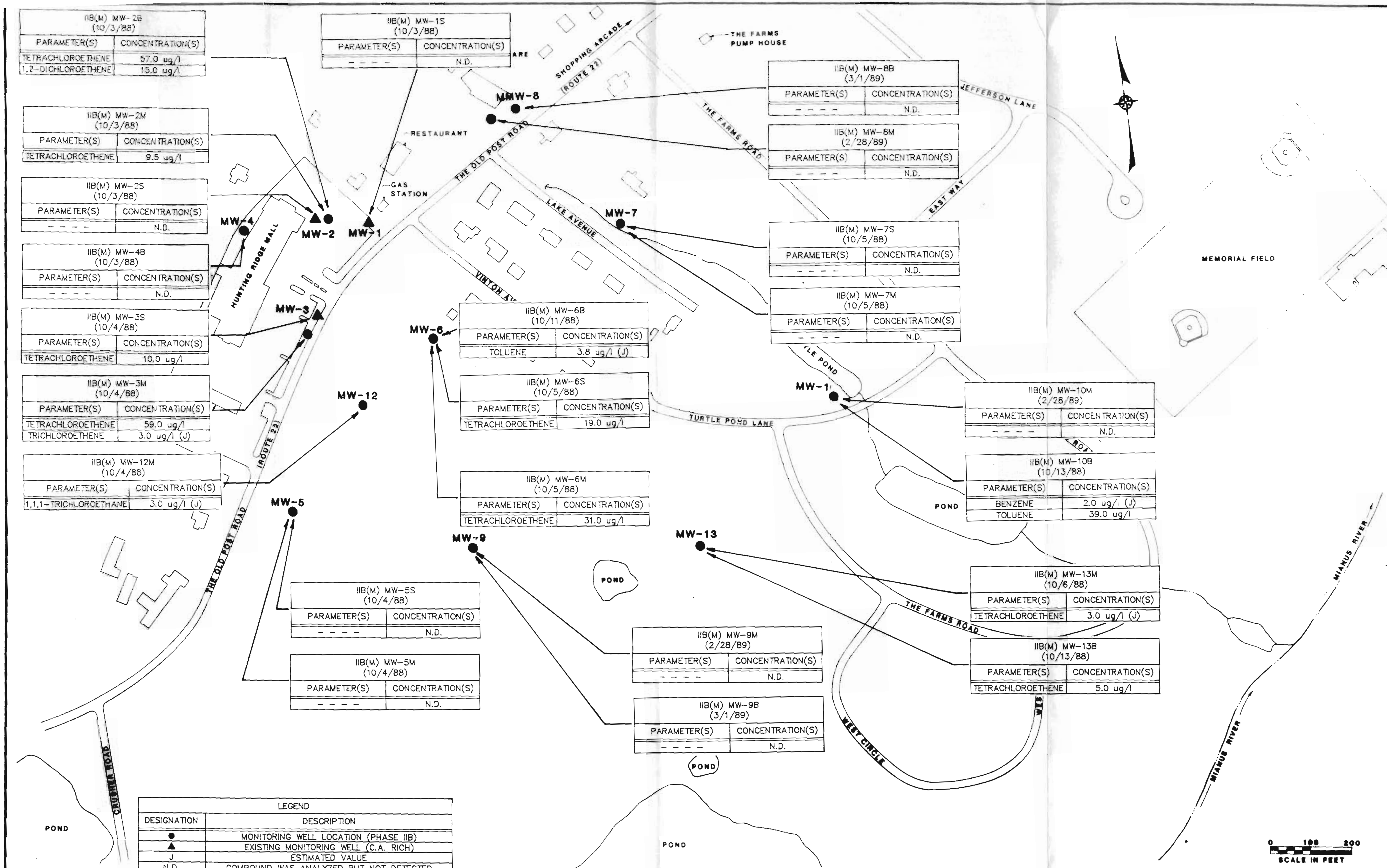
The Phase IIB sampling program generated the most complete data base of ground water contamination underlying the study area to date. This data is essential in determining where and how the analytes of concern are migrating through the ground water system underlying the study area, as well as revealing other possible contributing sources of contamination. This information will be incorporated in formulating the remedial design recommendation, if remediation is deemed necessary in the Hunting Ridge Mall Study Area.

Figure No. 4-10 presents a map of the study area which identifies the locations from which ground water samples were collected, along with the results of each sample for the analytes of concern and other organic contaminants detected. Similar to Phase IIA, for purposes of presenting the sampling program results, each sampling point is identified by an identification number. For example, for a sampling point labeled "IIB(M)MW-1S," the "IIB" portion of the identification number indicates that the sample was collected during the Phase IIB portion of the sampling program. For the remainder of the sample number, the nomenclature is the same as described for the Phase IIA samples in Section 4.3.

This sample identification number is also used on the Chain-of-Custody Forms and Field Log Forms. As such, background information regarding each sampling location including Location Sketches, field personnel involved, date and time, metereological conditions, etc., can be obtained from the Field Log Forms which are contained in the Field Report by cross referencing the forms to the appropriate sample identification number from Figure No. 4-10.

In the following sections, the sequence of data presentation will be by numerical order of the monitoring wells. For each location there is a presentation of organic sampling results for the compounds detected. Cases where analytes of concern were reported are specifically discussed.

A summary of the analytical results of all samples collected in the Hunting Ridge Mall Study Area during Phase IIB are presented in tabular format in Table No. 4-4. All samples were analyzed for Target Compound List (TCL) volatiles only. As mentioned above, the particular analytes of concern in this investigation are the organic compounds tetrachloroethene, trichloroethene, cis/trans-1,2-dichloroethene, vinyl chloride, 1,1,1-trichloroethane, and the BTX compounds (benzene, toulene and xylene).



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DESIGNED BY: CHECKED BY:

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CONSULTING ENGINEERS
Syosset, New York

BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
PHASE II B
ORGANIC CHEMICAL SAMPLING RESULTS

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 4-10

Table No. 4-4

BEDFORD VILLAGE
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
HUNTING RIDGE MALL PHASE IIB SAMPLING PROGRAM
ANALYTICAL RESULTS

PARAMETERS	IIB(M)MW1S 10/3/88 (ug/l)	IIB(M)MW2S 10/3/88 * (ug/l)	IIB(M)MW2SB 2/27/89 (ug/l)	IIB(M)MW2M 10/3/88 (ug/l)	IIB(M)MW2B 10/3/88 (ug/l)	IIB(M)MW3S 10/4/88 (ug/l)	IIB(M)MW3M 10/4/88 (ug/l)	IIB(M)MW4B 10/3/88 (ug/l)	IIB(M)MW5S 10/4/88 (ug/l)	IIB(M)MW5M 10/4/88 (ug/l)
Volatiles:										
Acetone	13.4		ND	35.0 B	10.0 B	6.0 BJ	9.0 BJ	21.0 B	6.0 BJ	6.0 BJ
Benzene	ND		ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND		ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND		ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND		ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND		ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND		ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND		ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	ND		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethylene(total)	ND		ND	ND	15.0	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND		ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND		ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND		ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	ND		ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND		ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	9.4 B		ND	11.0 B	9.3 B	6.0 B	9.0 B	8.4 B	9.0 B	9.0 B
4-Methyl-2-Pentanone	ND		ND	ND	ND	ND	ND	ND	ND	ND
Styrene	ND		ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	ND		ND	9.5	57.0	10.0	59.0	ND	ND	ND
Toluene	ND		ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND		ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND		ND	ND	ND	ND	3.0 J	ND	ND	ND
Vinyl Acetate	ND		ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND		ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	ND		ND	ND	ND	ND	ND	ND	ND	ND
Other:										
1,1,2-Trichloro-1,2,2-Tri-fluoro-ethane	26.0 J		ND	22.0 J	17.0 J	20.0 BJ	30.0 BJ	29.0 J	20.0 BJ	20.0 BJ
Unknown (total)	ND		ND	ND	ND	ND	ND	ND	5.0 J	5.0 J

Note: Samples were analyzed for volatile compounds only.

Table No. 4-4 (continued)

PARAMETERS	IIB(M)MW6S 10/5/88 ft (ug/l)	IIB(M)MW6M 10/5/88 ft (ug/l)	IIB(M)MW6B 10/11/88 (ug/l)	IIB(M)MW7S 10/5/88 ft (ug/l)	IIB(M)MW7M 10/5/88 ft (ug/l)	IIB(M)MW8M 10/5/88 + (ug/l)	IIB(M)MW8MB 2/28/89 (ug/l)	IIB(M)MW8B 10/5/88 + (ug/l)	IIB(M)MW8BB 3/1/89 (ug/l)
Volatiles:									
Acetone	ND	ND	10.0 B	ND	ND		ND		ND
Benzene	ND	ND	ND	ND	ND		ND		ND
Bromodichloromethane	ND	ND	ND	ND	ND		ND		ND
Bromoform	ND	ND	ND	ND	ND		ND		ND
Bromomethane	ND	ND	ND	ND	ND		ND		ND
2-Butanone	ND	ND	ND	ND	ND		ND		ND
Chlorobenzene	ND	ND	ND	ND	ND		ND		ND
Carbon Disulfide	ND	ND	ND	ND	ND		ND		ND
Carbon Tetrachloride	ND	ND	ND	ND	ND		ND		ND
Chloroethane	ND	ND	ND	ND	ND		ND		ND
Chloroform	ND	ND	ND	ND	ND		ND		ND
Chloromethane	ND	ND	ND	ND	ND		ND		ND
Dibromochloromethane	ND	ND	ND	ND	ND		ND		ND
1,1-Dichloroethane	ND	ND	ND	ND	ND		ND		ND
1,2-Dichloroethane	ND	ND	ND	ND	ND		ND		ND
1,1-Dichloroethylene	ND	ND	ND	ND	ND		ND		ND
1,2-Dichloroethylene(total)	ND	ND	ND	ND	ND		ND		ND
1,2-Dichloropropane	ND	ND	ND	ND	ND		ND		ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND		ND		ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND		ND		ND
Ethyl Benzene	ND	ND	ND	ND	ND		ND		ND
2-Hexanone	ND	ND	ND	ND	ND		ND		ND
Methylene Chloride	6.0	5.0 J	15.0 B	8.0	8.0		ND		ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND		ND		ND
Styrene	ND	ND	ND	ND	ND		ND		ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND		ND		ND
Tetrachloroethylene	19.0	31.0	ND	ND	ND		ND		ND
Toluene	ND	ND	3.8 J	ND	ND		ND		ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND		ND		ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND		ND		ND
Trichloroethene	ND	ND	ND	ND	ND		ND		ND
Vinyl Acetate	ND	ND	ND	ND	ND		ND		ND
Vinyl Chloride	ND	ND	ND	ND	ND		ND		ND
Total Xylenes	ND	ND	ND	ND	ND		ND		ND
Other:									
1,1,2-Trichloro-1,2,2-Tri-fluoro-ethane	ND	ND	3.0 J	ND	ND		ND		ND
Unknown (total)	ND	6.0 J	ND	ND	ND		ND		ND
Unknown Alkane	ND	ND	ND	ND	ND		ND		ND
Unknown Cyclic Compound	ND	ND	ND	ND	ND		ND		ND

Note: Samples were analyzed for volatile compounds only.

Table No. 1-4 (continued)

PARAMETERS	IIB(M)MW9M 10/4/88 + (ug/l)	IIB(M)MW9MB 2/28/89 (ug/l)	IIB(M)MW9B 10/4/88 + (ug/l)	IIB(M)MW9BB 3/1/89 (ug/l)	IIB(M)MW10M 10/5/88 + (ug/l)	IIB(M)MW10MB 2/28/89 (ug/l)	IIB(M)MW10B 10/13/88 (ug/l)	IIB(M)MW12M 10/4/88 (ug/l)	IIB(M)MW13M 10/6/88 (ug/l)	IIB(M)MW13B 10/13/88 (ug/l)
Volatiles:										
Acetone		ND		ND		ND	200.0 B	6.0 BJ	10.0 B	21.0 B
Benzene		ND		ND		ND	2.0 J	ND	ND	ND
Bromodichloromethane		ND		ND		ND	ND	ND	ND	ND
Bromoform		ND		ND		ND	ND	ND	ND	ND
Bromomethane		ND		ND		ND	ND	ND	ND	ND
2-Butanone		ND		ND		ND	ND	ND	ND	ND
Chlorobenzene		ND		ND		ND	ND	ND	ND	ND
Carbon Disulfide		ND		ND		ND	ND	ND	ND	ND
Carbon Tetrachloride		ND		ND		ND	ND	ND	ND	ND
Chloroethane		ND		ND		ND	ND	ND	ND	ND
Chloroform		ND		5.0		ND	10.0 J	ND	1.0 J	8.0
Chloromethane		ND		ND		ND	ND	ND	ND	ND
Dibromochloromethane		ND		ND		ND	ND	ND	ND	ND
1,1-Dichloroethane		ND		ND		ND	ND	ND	ND	ND
1,2-Dichloroethane		ND		ND		ND	ND	ND	ND	ND
1,1-Dichloroethylene		ND		ND		ND	ND	ND	ND	ND
1,2-Dichloroethylene(total)		ND		ND		ND	ND	ND	ND	ND
1,2-Dichloropropane		ND		ND		ND	ND	ND	ND	ND
cis-1,3-Dichloropropene		ND		ND		ND	ND	ND	ND	ND
trans-1,3-Dichloropropene		ND		ND		ND	ND	ND	ND	ND
Ethyl Benzene		ND		ND		ND	ND	ND	ND	ND
2-Hexanone		ND		ND		ND	ND	ND	ND	ND
Methylene Chloride		ND		ND		ND	140.0 B	8.0 B	11.0 B	22.0 B
4-Methyl-2-Pentanone		ND		ND		ND	ND	ND	ND	ND
Styrene		ND		ND		ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane		ND		ND		ND	ND	ND	ND	ND
Tetrachloroethylene		ND		ND		ND	ND	ND	3.0 J	5.0
Toluene		ND		ND		ND	39.0	ND	ND	ND
1,1,1-Trichloroethane		ND		ND		ND	ND	3.0 J	ND	ND
1,1,2-Trichloroethane		ND		ND		ND	ND	ND	ND	ND
Trichloroethene		ND		ND		ND	ND	ND	ND	ND
Vinyl Acetate		ND		ND		ND	ND	ND	ND	ND
Vinyl Chloride		ND		ND		ND	ND	ND	ND	ND
Total Xylenes		ND		ND		ND	ND	ND	ND	ND
Other:										
1,1,2-Trichloro-1,2,2-Tri-fluoro-ethane		ND		ND		ND	ND	20.0 BJ	ND	ND
Unknown (total)		ND		ND		ND	ND	ND	ND	ND
Unknown Alkane		26.0 J		ND		ND	ND	ND	ND	ND
Unknown Cyclic Compound		ND		ND		ND	8.0 J	ND	ND	ND

Note: Samples were analyzed for volatile compounds only.

Table No. 4-4 (continued)

PARAMETERS	Field Blank 10/3/88 (ug/l)	Trip Blank 10/3/88 (ug/l)	Field Blank 10/4/88 (ug/l)	Trip Blank 10/4/88 (ug/l)	Field Blank 10/5/88 + (ug/l)	Trip Blank 10/5/88 + (ug/l)	Field Blank 10/6/88 (ug/l)	Trip Blank 10/6/88 (ug/l)
Volatiles:								
Acetone	16.0 B	12.0 B	10.0 B	6.0 BJ			12.0 B	27.0 B
Benzene	ND	ND	ND	ND			ND	ND
Bromodichloromethane	ND	ND	ND	ND			ND	ND
Bromoform	ND	ND	ND	ND			ND	ND
Bromomethane	ND	ND	ND	ND			ND	ND
2-Butanone	ND	ND	ND	ND			ND	ND
Chlorobenzene	ND	ND	ND	ND			ND	ND
Carbon Disulfide	ND	ND	ND	ND			ND	ND
Carbon Tetrachloride	ND	ND	ND	ND			ND	ND
Chloroethane	ND	ND	ND	ND			ND	ND
Chloroform	ND	ND	2.0 J	ND			ND	ND
Chloromethane	ND	ND	ND	ND			ND	ND
Dibromochloromethane	ND	ND	ND	ND			ND	ND
1,1-Dichloroethane	ND	ND	ND	ND			ND	ND
1,2-Dichloroethane	ND	ND	ND	ND			ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND			ND	ND
1,2-Dichloroethylene(total)	ND	ND	ND	ND			ND	ND
1,2-Dichloropropane	ND	ND	ND	ND			ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND			ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND			ND	ND
Ethyl Benzene	ND	ND	ND	ND			ND	ND
2-Hexanone	ND	ND	ND	ND			ND	ND
Methylene Chloride	8.8 B	9.0 B	10.0 B	10.0 B			8.0 B	11.0 B
4-Methyl-2-Pentanone	ND	ND	ND	ND			ND	ND
Styrene	ND	ND	ND	ND			ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND			ND	ND
Tetrachloroethylene	ND	ND	ND	ND			ND	ND
Toluene	ND	ND	ND	ND			ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND			ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND			ND	ND
Trichloroethene	ND	ND	ND	ND			ND	ND
Vinyl Acetate	ND	ND	ND	ND			ND	ND
Vinyl Chloride	ND	ND	ND	ND			ND	ND
Total Xylenes	ND	ND	ND	ND			ND	ND
Other:								
1,1,2-Trichloro-1,2,2-Tri-fluoro-ethane	ND	ND	10.0 BJ	20.0 BJ			13.0 J	ND
Unknown Alkane	ND	7.0 J	ND	ND			ND	ND
Unknown Hydrocarbon	8.0 J	ND	ND	ND			ND	ND

Note: Samples were analyzed for volatile compounds only.

Table No. 4-1 (continued)

PARAMETERS	Field Blank 10/11/88 (ug/l)	Trip Blank 10/11/88 (ug/l)	Field Blank 10/13/88 (ug/l)	Trip Blank 10/13/88 (ug/l)	Field Blank 2/28/89 (ug/l)	Trip Blank 2/27/89 (ug/l)	Field Blank 3/1/89 (ug/l)	Trip Blank 3/1/89 (ug/l)
Volatiles:								
Acetone	12.0 B	11.0 B	21.0 B	26.0 B	43.0	ND	7.0 J	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	[illegible].0 J	2.0 J	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethylene(total)	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	15.0 B	19.0 B	32.0 B	36.0 B	2.0 J	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	5.0	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	2.0 J
Vinyl Acetate	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	ND
Other:								
1,1,2-Trichloro-1,2,2-Tri-fluoroethane	[illegible].0 J	5.0 J	ND	ND	ND	ND	ND	ND
Unknown Alkane	ND	ND	ND	ND	ND	ND	ND	ND
Unknown Hydrocarbon	ND	ND	ND	ND	ND	ND	ND	ND

Note: Samples were analyzed for volatile compounds only.
U - Indicates compound was analyzed for but not detected. Reported with the instrument detection limits
J - Indicates an estimated value.
B - This flag is used when the the analyte is found in the blank as well as a sample.
* - Holding Time Exceeded For Volatiles
** - Holding time for field/trip blanks was exceeded for volatiles
ND - Not detected
[illegible]

It is important to note that as shown in Table No. 4-4, multiple samples were obtained and analyzed at several locations during the Phase IIB sampling program because some of the initial analyses did not meet NYSDEC QA/QC requirements and the results were deemed invalid. Therefore, only those analytical results that met the NYSDEC QA/QC requirements for Target Compound List (TCL) volatiles analysis and resultant valid data is shown in both Table No. 4-4 and Figure No. 4-10, and presented in this report for discussion.

As listed in Table No. 4-4, where a compound was not measured in a sample, the data is presented using the following qualifiers:

- o A <u>blank</u> space indicates that the analysis of the compound did not meet the NYSDEC CLP QA/QC requirements and was therefore deemed <u>invalid</u> and not shown.

- o The symbol "ND" indicates that the analysis of this compound met the NYSDEC CLP QA/QC requirements, but was not measured above the analytical instrument's detection limits (IDL).

- o The symbol "NA" indicates that the compound was not analyzed.

Qualifiers that accompany the concentrations reported in the table are the NYSDEC CLP concentration qualifiers.

In addition, several sample results show the presence of unknown isomers and "other" compounds. These compounds are listed in the table and presented in the text, however, identification and determination of the exact levels of the compounds, as well as a discussion of their presence and extent of contamination is not definable within the context of this program and will be excluded from discussions. In order to more clearly identify and define possible contamination by these compounds, additional sampling would be necessary with the primary focus of analysis based on these parameters.

4.5.1 <u>Monitoring Well MW-1 (MW-1S [33'])</u>

MW-1S is one of the three monitoring wells installed by the Mall owner in 1985. MW-1S is a shallow (overburden/water table) monitoring well. MW-1S was also sampled during the Phase IIA portion of this sampling program.

4.5.1.1 Organic Sampling Results

The analytical results for sample IIB(M)MW-1S contained the compounds listed below. Consistent with the samples collected in Phase IIA, the analytes of concern were not detected in the sample.

Compound	Concentration (ug/l)
Methylene chloride	9.4 B
Acetone	13.4
1,1,2-Trichloro-1,2,2-trifluoroethane	26.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

1,1,2-Trichloro-1,2,2-trifluoroethane, which is commonly referred to as freon, was found in the method blanks, as well as in a number of trip and field blanks in Phase IIB, and is most likely a laboratory contaminant. Similar to Phase IIA, methylene chloride and acetone (as well as chloroform and carbon disulfide) are also probably laboratory contaminants.

4.5.2 Monitoring Well Cluster MW-2 (MW-2S [18'], MW-2M [47'] and MW-2B [90'])

MW-2S is one of the three shallow monitoring wells constructed in the parking lot of the Hunting Ridge Mall Site as part of the 1985 ground water investigation. MW-2 was chosen as a location to install complementary monitoring wells because the shallow well indicated a significant concentration of contamination during a previous sampling program. All three wells were sampled as part of the Phase IIA, as well as the Phase IIB program. Except for the sample from MW-2S (which initially showed trichloroethene at 8 ug/l), the results of Phase IIB were similar to Phase IIA. In addition, trichloroethene was initially found in MW-2M (at 1.0 ug/l) and MW-2B (at 3.0 ug/l) during Phase IIA, but not in IIB.

4.5.2.1 Organic Sampling Results

Please note that the initial sample at MW-2S failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid results are presented. No organic compounds were found in sample IIB(M)MW-2S.

The analytical results for sample IIB(M)MW-2M contained the following compounds, of which tetrachloroethene is an analyte of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	9.5
Methylene chloride	11.0 B
Acetone	35.0 B
1,1,2-Trichloro-1,2,2-trifluoroethane	22.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

The analytical results for sample IIB(M)MW-2B contained the following compounds, of which tetrachloroethene and 1,2-dichloroethene (total) are analytes of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	57.0
1,2-Dichloroethene (total)	15.0
Methylene chloride	9.3 B
Acetone	10.0 B
1,1,2-Trichloro-1,2,2-trifluoroethane	17.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.5.3 Monitoring Well Cluster MW-3 (MW-3S [19'] and MW-3M [73']

MW-3S is one of the three shallow monitoring wells also constructed at the Mall site as part of the 1985 ground water investigation. Adjacent to MW-3S, a mid-depth well (MW-3M) was constructed during the Phase IIA investigation. Both of these wells were sampled during the Phase IIB, as well as the Phase IIA sampling program, the results of which are similar for MW-3S; however, MW-3M in Phase IIA also indicated the presence of low levels of 1,1,1-trichloroethane and benzene which were not detected in Phase IIB.

4.5.3.1 Organic Sampling Results

The analytical results for sample IIB(M)MW-3S are listed below. Tetrachloroethene is an analyte of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	10.0
Methylene chloride	6.0 B

Acetone	6.0 BJ
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0 BJ

"J" indicates estimated value.
"B" indicates compound found in method blank.

The analytical results for sample IIB(M)MW-3M were the following, of which tetrachloroethene and trichloroethene are analytes of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	59.0
Trichloroethene	3.0 J
Methylene chloride	9.0 B
Acetone	9.0 BJ
1,1,2-Trichloro-1,2,2-trifluoroethane	30.0 BJ

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.5.4 Monitoring Well MW-4 (MW-4B [84.3'])

The location for monitoring well MW-4B was originally chosen to provide soil and ground water quality information immediately adjacent to a suspected source of contamination (the Mall sanitary system). Bedrock at this location was encountered at a depth of 4 feet below ground surface. Since evidence of saturation did not exist in the overburden soils at this location, a well was not constructed in the unconsolidated deposits. In Phase IIA, a PVC casing was grouted in the bedrock and 30 feet of rock core were removed from the boring. When the well was completed and sampled as part of the Phase IIA program the analytes of concern were not detected in the ground water. As previously mentioned, it was decided to deepen MW-4B during the Phase IIB drilling program so as to bisect more water bearing fractures in the rock.

4.5.4.1 Organic Sampling Results

The organic compounds detected in sample IIB(M)MW-4B are listed below. Similar to the results of Phase IIA, analytes of concern were not detected in this sample.

Compound	Concentration (ug/l)
Methylene chloride	8.4 B
Acetone	21.0 B

1,1,2-Trichloro-1,2,2-trifluoroethane	29.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.5.5 Monitoring Well Cluster MW-5 (MW-5S [43'] and MW-5M [67'])

Monitoring well cluster MW-5 was constructed during Phase IIA on the Ponds Development Property just south of Route 22 and downgradient of the Hunting Ridge Mall. These monitoring wells provide ground water quality data in the unconsolidated stratified drift deposits immediately south of the Mall migrating towards the Mianus River. The wells were initially sampled during the Phase IIA sampling program. The results of the Phase IIA sampling program were consistent with Phase IIB except that benzene was initially detected in MW-5S in low concentrations (3.0 ug/l).

4.5.5.1 Organic Sampling Results

The analytical results for sample IIB(M)MW-5S are provided below. The analytes of concern were not detected in this sample.

Compound	Concentration (ug/l)
Methylene chloride	9.0 B
Acetone	6.0 BJ
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0 BJ
Unknown (total)	5.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

The analytical results for sample IIB(M)MW-5M are provided below, and again the analytes of concern were not detected in this sample.

Compound	Concentration (ug/l)
Methylene chloride	9.0 B
Acetone	6.0 BJ
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0 BJ
Unknown (total)	5.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.5.6 Monitoring Well Cluster MW-6 (MW-6S [44'], MW-6M [58'] and MW-6B [159'])

Monitoring well cluster MW-6 was also constructed on the Ponds Development Property just south of Route 22 and downgradient of the Hunting Ridge Mall. These monitoring wells provide additional ground water quality data in the unconsolidated stratified drift deposits located immediately southeast of the Mall and migrating towards the Mianus River. MW-6S and MW-6M were constructed and sampled during the Phase IIA program. The sampling results indicated that the presence of volatile organic contamination/analytes of concern exist in the ground water obtained from the two wells. In consultation with the NYSDEC, it was decided that concentrations of organic contaminants, as well as the downgradient location (of the Mall) of MW-6, would be a suitable location to construct a deep bedrock well. In this way the interrelationship of contaminant migration within unconsolidated deposits and the bedrock zone could be determined. The deep bedrock well was constructed at the MW-6 location during the Phase IIB drilling program. The analytical results for MW-6S and MW-6M in Phases IIA and IIB are similar. However, trichloroethene and 1,2-dichloroethene were found initially in MW-6S during Phase IIA but not in IIB, and trichloroethene was detected in MW-6M in Phase IIA but not in IIB.

4.5.6.1 Organic Sampling Results

The analytical results for sample IIB(M)MW-6S contained the following compounds, of which tetrachloroethene is an analyte of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	19.0
Methylene chloride	6.0

The analytical results for sample IIB(M)MW-6M contained the following compounds of which tetrachloroethene is again an analyte of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	31.0
Methylene chloride	5.0 J
Unknown (total)	6.0 J

"J" indicates estimated value.

The analytical results for sample IIB(M)MW-6B are listed below. The analyte of concern detected in this ground water sample was toluene.

Compound	Concentration (ug/l)
Toluene	3.8J
Methylene chloride	15.0B
Acetone	10.0B
1,1,2-Trichloro-1,2,2-trifluoroethane	8.0J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.5.7 Monitoring Well Cluster MW-7 (MW-7S [20.5'] and MW-7M [72']

Monitoring well cluster MW-7 was constructed on Lake Avenue adjacent to the stream bed that receives the stormwater drainage from the Hunting Ridge Mall. Monitoring at this location provides ground water quality data in the drainage area east of the Mall and assists in determining if this area is a secondary source of contamination due to past discharges to the drainage system of the Mall. Monitoring well cluster MW-7 was installed and sampled during the Phase IIA program. The Phase IIA and Phase IIB results for both MW-7S and MW-7M are consistent.

4.5.7.1 Organic Sampling Results

The analytical results for sample IIB(M)MW-7S contained the following compound. Analytes of concern were not detected in this sample.

Compound	Concentration (ug/l)
Methylene chloride	8.0

The analytical results for sample IIB(M)MW-7M contained the following compounds, and the analytes of concern were again not detected in this sample.

Compound	Concentration (ug/l)
Methylene chloride	8.0

4.5.8 Monitoring Well Cluster MW-8 (MW-8M [45'] and MW-8B [68'])

Monitoring well cluster MW-8 was installed downgradient of the hardware store just northeast of the intersection of Lake Avenue and Route 22. Monitoring at this location will determine if the hardware store disposal practices may have contributed to ground water contamination within the study area.

4.5.8.1 Organic Sampling Results

Please note that the initial sample at MW-8M failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid results are presented. No organic compounds were detected in resample IIB(M)MW-8MB. However, it is important to note that based upon prior laboratory results, there is a strong possibility that resamples IIA(A)MW-3MA (Shopping Arcade Site) and IIB(M)MW-8MB were inadvertently switched at the laboratory prior to analysis during the resampling program. Past laboratory results showed that high concentrations of contaminants were found in sample IIA(A)MW-3M and not in sample IIB(M)MW-8M. However, the latest resampling results showed high concentrations of the same contaminants in resample IIB(M)MW-8MB, not in resample IIA(A)MW-3MA as found previously at this location. In addition, these two samples were analyzed with one immediately following the other.

The laboratory was notified and asked to investigate this situation. The laboratory which analyzed these samples could not determine if and when this error occurred; however, it was acknowledged that there exists the possibility of an error to occur when the sample is transferred from the sample vial to the analysis vial prior to analysis, as documented in their letter dated May 3, 1989 which is enclosed in Appendix G.

Please note that the initial sample at MW-8B failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid results are presented. No organic compounds were detected in sample IIB(M)MW-8B.

4.5.9 Monitoring Well Cluster MW-9 (MW-9M [83.5'] and MW-9B [124.5'])

Well cluster MW-9 is located on the Ponds Development Property downgradient of MW-5 and MW-6 well locations. The MW-9 well location helps define the downgradient extent of ground water contamination within the study area.

4.5.9.1 Organic Sampling Results

Only one unidentified compound was found in sample IIB(M)MW-9M. No analytes of concern were detected. (Please note that the initial sample failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Unknown alkane	26.0 J

"J" indicates estimated value.

The only organic compound detected in sample IIB(M)MW-9B is provided below. The analytes of concern were not detected in the sample. (Please note that the initial sample failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented.)

Compound	Concentration (ug/l)
Chloroform	5.0

4.5.10 Monitoring Well Cluster MW-10 (MW-10M [132'] and MW-10B [180'])

Monitoring well cluster MW-10 is located the furthest east and south of all other monitoring well locations within the study area. MW-10 is located downgradient of the MW-7 and MW-6 well locations. MW-10 ground water data helps define the migration of the contaminant plume within the study area.

4.5.10.1 Organic Sampling Results

Please note that the initial sample at MW-10M failed QA/QC requirements for volatiles. Therefore, this location was resampled and reanalyzed and only these valid analytical results are presented. No organic compounds were detected in sample IIB(M)MW-10M.

The analytical results for sample IIB(M)MW-10B are provided below of which benzene and toluene are analytes of concern.

Compound	Concentration (ug/l)
Benzene	2.0 J
Toluene	39.0
Methylene chloride	140.0 B
Acetone	200.0 B
Chloroform	10.0 J
Unknown cyclic compound	8.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.5.11 Monitoring Well MW-12 (MW-12M [64.6'])

Monitoring well MW-12 was installed on the Ponds Development Property in an area where the soil gas survey conducted by USEPA exhibited elevated levels of volatile organic chemicals. This monitoring well location assists in defining the lateral extent of the contaminant plume.

4.5.11.1 Organic Sampling Results

The analytical results for sample IIB(M)MW-12M are provided below, of which 1,1,1-trichloroethane is an analyte of concern.

Compound	Concentration (ug/l)
1,1,1-Trichloroethane	3.0J
Methylene chloride	8.0 B
Acetone	6.0 BJ
1,1,2-Trichloro-1,2,2-trifluoroethane	20.0 BJ

"J" indicates estimated value.
"B" indicates compound found in method blank.

4.5.12 Monitoring Well Cluster MW-13 (MW-13M [110'] and MW-13B [154'])

The MW-13 well cluster is located on the Ponds Development Property and is the furthest southeast and downgradient monitoring well location within the study area. The MW-13 location is located downgradient of the MW-6 well location where volatile organic contamination is present. This well location helps define the extent of migration of contaminants within the study area.

4.5.12.1 Organic Sampling Results

The analytical results for sample IIB(M)MW-13M are provided below, of which tetrachloroethene is an analyte of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	3.0 J
Methylene chloride	11.0 B
Acetone	10.0 B
Chloroform	1.0 J

"J" indicates estimated value.
"B" indicates compound found in method blank.

The analytical results for sample IIB(M)MW-13B are provided below, of which tetrachloroethene is again an analyte of concern.

Compound	Concentration (ug/l)
Tetrachloroethene	5.0
Methylene chloride	22.0 B
Acetone	21.0 B
Chloroform	8.0

"B" indicates compound found in method blank.

4.6 Geology

4.6.1 Regional Geomorphology

The following description of regional geology was obtained from a report prepared for the Town of Bedford by Leggette, Brashers and Graham, Inc. entitled "Ground Water Assessment - Town of Bedford, New York, December, 1985."

4.6.1.1 Physical Setting

The Town of Bedford, New York is located in northeastern Westchester County in an area of varied and rugged topography. The Town encompasses approximately 40 square miles, or 25,400 acres, of which about 1,300 acres are covered by water, leaving 24,100 acres of land area. Large water bodies include most of the Cross River Reservoir and parts of the New York City reservoir system, and the northern part of Byram Lake which provides drinking water for Mount Kisco.

The northern and southern parts of the Town are typified by ridges and rounded hills with steep slopes and high elevations. The highest elevations in Bedford are more than 800 feet above sea level on Chestnut Ridge, south and east of the Hunting Ridge Mall Site, and 760 feet on Mount Aspetong in east-central Bedford. Rolling hills of lesser relief characterize the topography at the site which also borders the wetlands associated with the Mianus River Valley.

Drainage from the Hunting Ridge Mall Site is to the south, eventually to Long Island Sound. The Mianus River, located approximately 1/2 mile southeast of the Mall, cuts through hills forming a curving valley which is as much as two-thirds of a mile wide in places, before turning into the narrow fault controlled Mianus Gorge. The Mianus River Valley contains relatively flat flood plains which are commonly covered by swamps and ponds. The river drains an area of about five square miles within Bedford which contributes to the Mianus Reservoir, a public water supply impoundment in Stamford that serves the Town of Greenwich, Connecticut (see Figure No. 4-11).

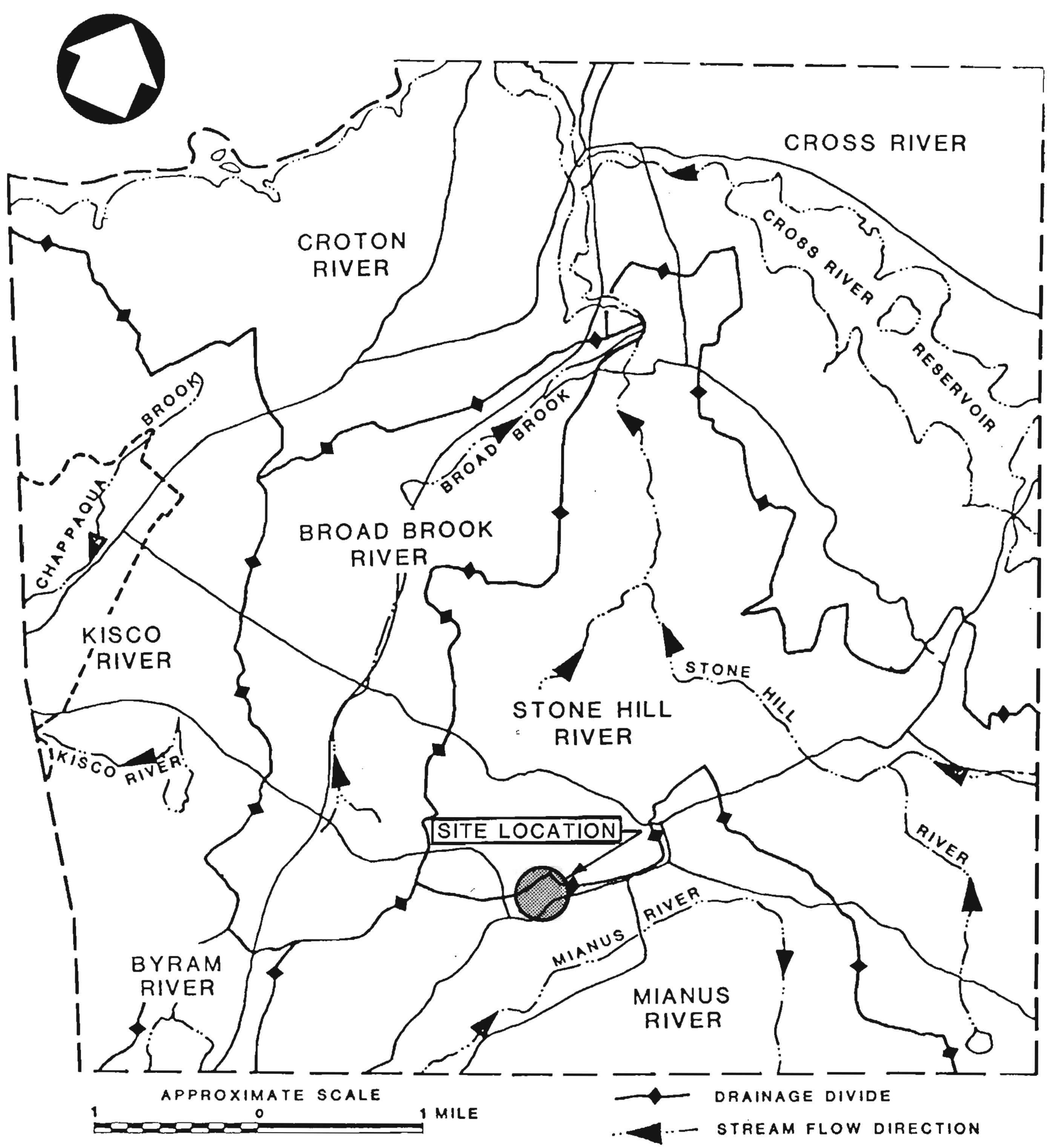
4.6.1.2 General Description of Geology

The Town of Bedford lies in the Manhattan Prong of the New England Upland physiographic province of the United States. In general, in this part of Westchester County, the highest hills are underlain by gneiss and granite, intermediate elevations by schist, and the main valleys by marble. The present land surface was smoothed and sculpted by Pleistocene glaciation, which ended in this area about 14,000 years ago.

4.6.1.3 Bedrock Geology

The bedrock geology of Bedford is the subject of several reports, and has been depicted on several regional and local geologic maps. This information is summarized in the Westchester County Areawide Waste Management Plan.

The bedrock of Bedford, comprising five different metamorphic crystalline rock formations, is the foundation for the present land forms and topographic relief. The relative susceptibility of the bedrock types to erosion by the passage and retreat of at least two stages of continental glaciation shaped the present land surface, with only geologically-minor changes occurring since that time. The five different formations that comprise the bedrock geology of Bedford include the Fordham Gneiss, Bedford Gneiss, Manhattan Schist, Manhattan Gneiss and the Inwood Marble which collectively make up the New York City Group, lower Paleozoic and/or PreCambrian in age.



SOURCE: LEGGETTE, BRASHEARS & GRAHAM, INC.

BEDFORD VILLAGE WELLS
HUNTING RIDGE MALL STUDY AREA

Dvirka and Bartilucci CONSULTING ENGINEERS

TOWN OF BEDFORD
DRAINAGE BASINS

FIGURE NO. 4-11

Figure No. 4–12 depicts the general occurrence of the bedrock formations in the Town of Bedford. The most abundant of the rock types is Fordham Gneiss, a rock with pronounced compositional banding which forms most of the hills and ridges in Bedford. A similar rock, Bedford Gneiss, occurs in the southeast corner of the Town. These types of bedrock are visible in many roadcuts and on steep slopes adjacent to lowlands. Fresh exposures of Fordham Gneiss occur in the Route I–684 roadcut to the south of the Route 172 interchange. Natural outcrops are generally massive and rounded. Banding is prominent except on weathered surfaces, where the rock is a somewhat uniform dark gray. The chief difference between the two Gneisses is mineralogical, with the Bedford Gneiss showing less complexity.

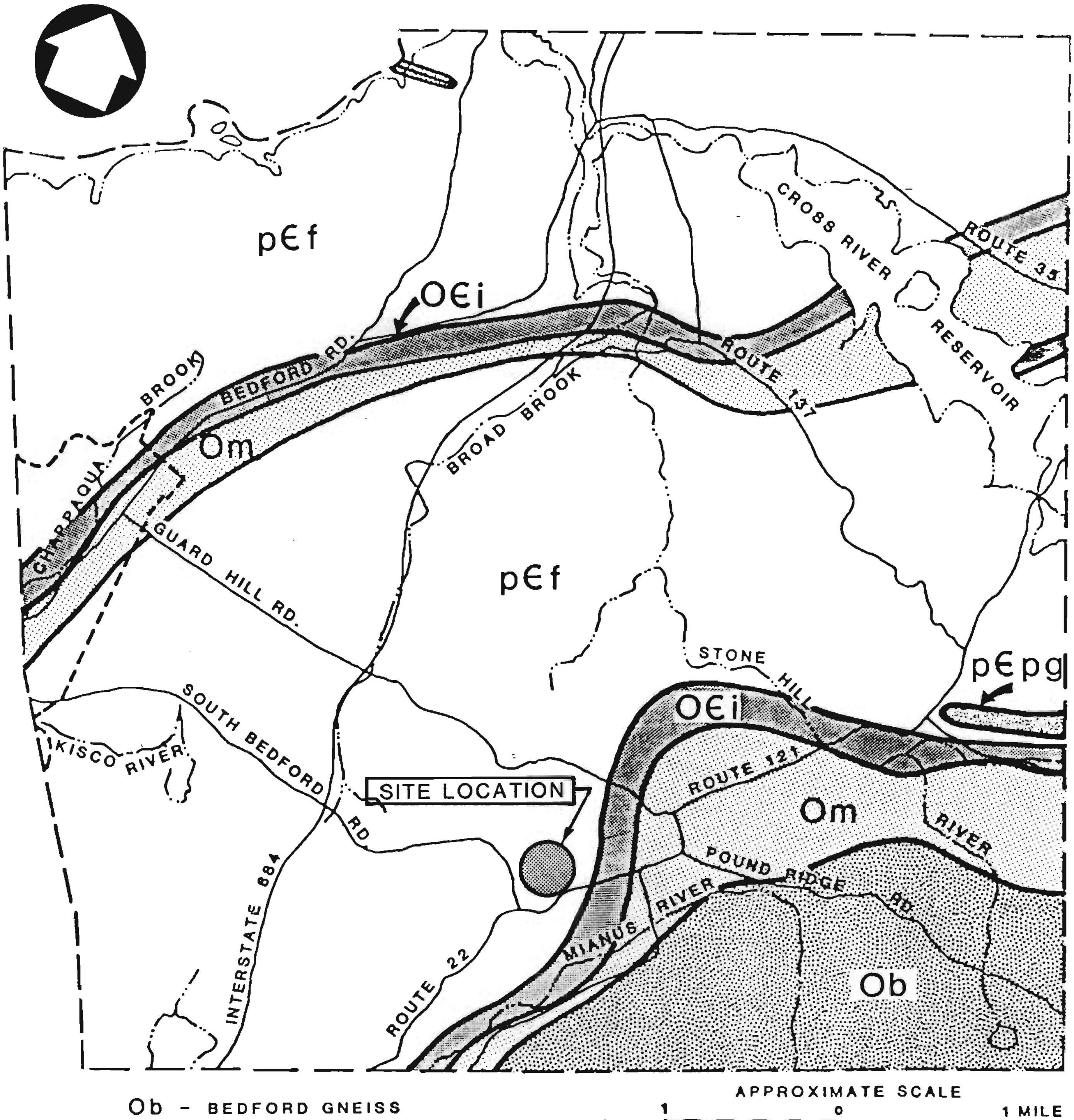
Two other crystalline rock types occur in narrow bands across the north central part of the Town, and separate the Fordham and Bedford Gneisses in the southeast. These bands are composed of Manhattan Formation schist and gneiss, and the Inwood Marble. Abundant slabby outcrops of strongly–foliated rusty brown rock occur on hills composed of Manhattan Schist. This rock contains a significant amount of mica, accounting for the sheen that is sometimes noticeable.

Inwood Marble commonly underlies lowland swamps and stream valleys and is only rarely found in natural outcrops. The occurrence of cleavage grains within the soil and/or of stands of Equisetum (horsetail plant) indicates the presence of this lithology in the subsurface. Where exposed in outcrop, usually in roadcuts, the marble is white to gray on fresh surfaces and rusty brown where weathered.

Pound Ridge Gneiss occurs in a single narrow band just north of the Stone Hill River at the eastern Town boundary. This pink "granite–like" rock displays moderate to strong foliation.

4.6.1.4 Surficial (Unconsolidated) Geology

Surficial geologic maps have not been published for the Town of Bedford area. The report prepared by Leggette, Brashers and Graham delineated and characterized the surficial deposits using a number of sources. These included a manuscript map prepared by the Westchester County Department of Planning, photographic soil maps from the Westchester County Soil and Water Conservation District, and residential well records obtained from the Westchester County Department of Health.



Ob - BEDFORD GNEISS

Om - MANHATTAN FORMATION

OЄi - INWOOD MARBLE

pЄf - FORDHAM GNEISS

pЄpg - POUND RIDGE GNEISS

SOURCE: LEGGETTE, BRASHEARS & GRAHAM, INC.

BEDFORD VILLAGE WELLS
HUNTING RIDGE MALL STUDY AREA

TOWN OF BEDFORD
BEDROCK GEOLOGY

Dvirka and Bartilucci CONSULTING ENGINEERS

FIGURE NO. 4-12

Most uplands and hill slopes in Bedford are covered with glacial till, a heterogeneous unsorted mixture of clay, silt, sand, gravel and boulders. Two types of till are associated with the glacial deposition: lodgement till, which was deposited beneath the moving glacier and is commonly very compact and relatively impermeable; and ablation till, which was released by the glacier as it melted and is less dense and more permeable. Most till deposits in Bedford are of the latter type, some of which are quite permeable and well drained. Lodgement till commonly occurs as drumlinoid hills or ridges. Till deposits range from inches to tens of feet thick in Bedford.

Glacial stratified drift underlines most of the stream valleys and swampy lowlands. These sorted deposits of sand, silt, clay and gravel also occur in some upland terraces and within zones of significant bedrock faulting. Glacial outwash sediments (deposited by running water) are well sorted. This mode of deposition produces strata composed of material with similar textural and hydrologic properties. These deposits may vary considerably from place to place and throughout the vertical section due to the meadering nature of glacial streams. The result is sediment with differing capacity for storing and transmitting water. In addition, glacial lacustrine deposits, which may occur on outwash deposits, are very fine grained and do not generally form productive aquifers. Stratified-drift sediments range in thickness from inches to approximately 200 feet within Bedford.

4.6.2 Site Geomorphology

4.6.2.1 Bedrock Geology

The Hunting Ridge Mall Study Area is located on the northern edge of the Mianus River Valley immediately adjacent to an outcropping ridge line composed of Fordham Gneiss. The ridge of Fordham Gneiss slopes steeply under the Mall and continues sloping southeast towards the Mianus River.

Lithology and Structure

The bedrock underlying the study area is composed predominantly of Fordham Gneiss. The Fordham Gneiss typically consists of a hard, grey to white banded rock with fine to medium grained crystals in matrix and large potassium and calcium feldspar crystals in the bands. The Fordham Gneiss also contains an abundance of biotite.

Located in the southeastern portion of the study area (at the MW-10 monitoring well location), the Inwood Marble was encountered at a depth of 148 feet below ground surface. Although this was the only boring location at the Hunting Ridge Mall Study Area in which the Inwood Marble was encountered, it was also found at two locations in the adjacent Shopping Arcade Study Area. Although the continuity of the Inwood Marble zone in the Mianus River Valley is questionable in all three instances it was encountered, it was found below the overlying Fordham Gneiss and was relatively deep below ground surface.

Many of the bedrock borings encountered zones of high calcium concentrations within the Fordham Gneiss and zones within the Inwood Marble that contained a significant quantity of mafic minerals. The structural relationship between these units is complex and not clearly understood.

The regional Bedford geology map prepared by Leggette, Brashears and Graham (see Figure No. 4-12) notes a thin line (1/4 mile wide) of Inwood Marble transversing through the Mianus River Valley. This is most likely the unit encountered at the MW-10 boring location.

Bedrock Core Samples

Continuous rock core samples were collected in the borings advanced into each of the bedrock wells constructed during this investigation. The rock cores were examined to establish the lithology and physical characteristics of the bedrock unit. A complete visual description of the rock cores were made which included rock type, color, hardness, grain size and shape, boring, cementation and fracturing. (For a detailed description of each rock core collected, refer to the boring logs in Appendix D.)

The top 10 to 15 feet of the Fordham Gneiss was extensively fractured and weathered. A descriptive term referred to as RQD (which is the total length of rock core greater than twice the rock core diameter, divided by the run length) calculates a relative value of rock competency (fracturing). The greater the RQD value, the greater the relative competency of the rock unit (fracturing decreases). In review of the RQD values calculated for the individual rock core runs obtained in the Hunting Ridge Mall Study Area, generally the Fordham Gneiss exhibited fewer fracture zones with depth. This data is important in the review of fluid migration within the fractured metamorphic rock underlying the study area. It appears that there is a pathway for ground water to migrate into the bedrock underlying the stratified drift deposits in the Mianus River Valley.

However, the migration of ground water through the bedrock zone will be controlled by fracture density, the interconnection of fractures and the pressures associated with the fluids contained within the fractures.

Bedrock Topography

A bedrock contour map has been prepared for the Hunting Ridge Mall Study Area and is presented in Figure No. 4-13. Fordham Gneiss outcrops directly behind the Mall and forms a ridge line which trends northeast-southwest. The Fordham Gneiss slopes steeply under the Mall. At boring location MW-4 behind the Mall building, the gneiss was encountered 4 feet below ground surface. At boring location MW-2, just east of the Mall building, the gneiss was encountered at 47 feet below ground surface. At boring MW-3, which is located approximately 130 feet in the front of the Mall building, bedrock was encountered 72 feet below ground surface.

It appears that the bedrock surface from Route 22 to the Mianus River slopes to the southeast with a gradient of 0.012 feet (vertical) per 1 foot (horizontal).

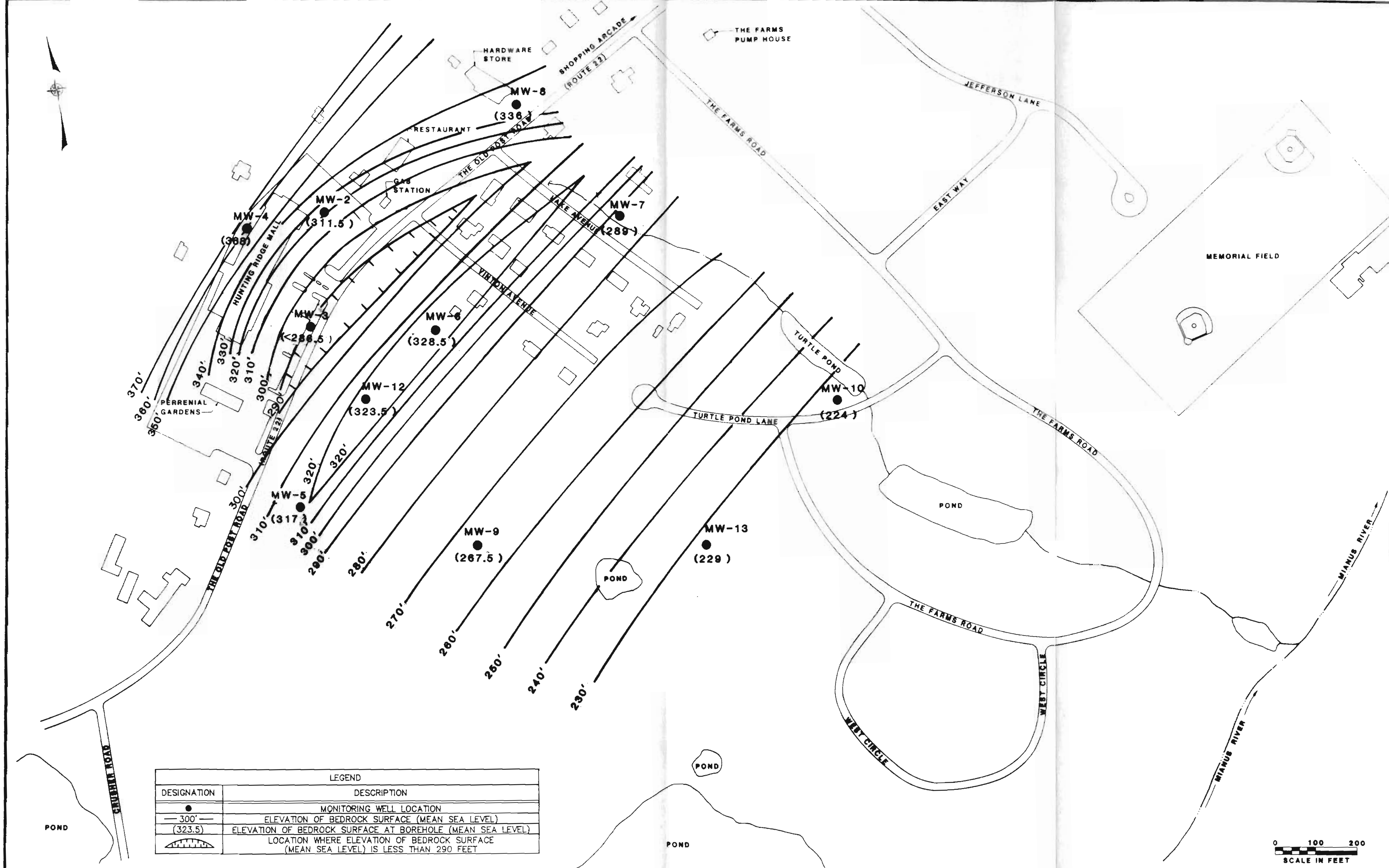
The thickest stratified drift deposits (bedrock at greatest depth below ground surface) documented in the Hunting Ridge Mall Study Area was at the MW-13 boring location where bedrock was encountered at 131 feet below ground surface. This boring/well location is the furthest downgradient in the study area.

4.6.2.2 Soil Geology

Overlying the Fordham Gneiss bedrock in the Mianus River Valley and underlying the Hunting Ridge Mall Study Area are glacial stratified drift deposits. These deposits are generally composed of sorted fine-coarse sands and silts and are described below in detail.

Soil Borings

Early in the Remedial Investigation, a geophysical survey was conducted in the Hunting Ridge Mall Study Area. One of the objectives of this survey was to determine the thickness of the glacial stratified drift deposits within the Mianus River Valley. Examination of this data assisted in planning the depths at which ground water monitoring wells would be placed.



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION
— 300' —	ELEVATION OF BEDROCK SURFACE (MEAN SEA LEVEL)
(323.5)	ELEVATION OF BEDROCK SURFACE AT BOREHOLE (MEAN SEA LEVEL)
(hatched symbol)	LOCATION WHERE ELEVATION OF BEDROCK SURFACE (MEAN SEA LEVEL) IS LESS THAN 290 FEET

NO.	DATE	REVISION	INT.

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DESIGNED BY: CHECKED BY:

Dvirka and Bartilucci
CONSULTING ENGINEERS
Syosset, New York

BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
BEDROCK SURFACE
CONTOUR MAP

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 4-13

During construction of the deepest borehole at each well cluster, split spoon samples were obtained at five foot intervals in the unconsolidated deposits to classify the stratigraphic sequences underlying the study area. The samples were logged characterizing the soil type, color, grain size and moisture content. Detailed descriptions of these soil samples are provided in the boring logs contained in Appendix D.

Unconsolidated Stratigraphic Sequences

Overlying the Fordham Gneiss in the Hunting Ridge Mall Study Area is a weathered bedrock zone. This zone is composed of highly fragmented and weathered bedrock that has little structural integrity. The movement and interaction of ground water at the soil/bedrock interface is the primary cause for this weathered zone. The weathered bedrock zone was encountered in all soil borings advanced to bedrock except the boring at the MW-4 location. The lack of weathering at this location is probably a result of the water table being situated below the bedrock surface.

Overlying the weathered gneiss and comprising the majority of the unconsolidated deposits in the Mianus River Valley in the study area are fine to very fine grey sands. At many of the boring locations, the sand was so finely 'pulverized' that a grain size analysis (ASTM D-2487 w/o hydrometer) was conducted to confirm whether or not 0.010 slot stainless steel screen was a fine enough mesh to keep the formation from silting up the monitoring wells. The results of the test showed that the soil samples may be classified as SP-SM (poorly graded sand with appreciable fines) and 0.006 slot stainless steel screens were used in the construction of several of the wells.

Southeast of the Hunting Ridge Mall in the planned Ponds Development Property area, the sands grade laterally into a coarser grained deposit in the upper 50 to 80 foot zone below ground surface towards the Mianus River. These sands were generally 'cleaner' (less silt) and coarser than the other sand deposits encountered in the study area.

On Lake Avenue, adjacent to the stream bed which is the headwaters of the Turtle Pond drainage system, a significant (8 foot thick) organic peat zone was encountered in boring MW-7. This organic peat zone was located close to the ground surface (4 foot below grade) and is an indicator of the wetlands/stream bed permanancy.

Generally, the unconsolidated deposits consist of a weathered rock zone immediately above bedrock ranging from 5 to 20 feet in thickness. Overlying the weathered zone is a fine sand unit which ranges from 0 to 130 feet in thickness. This fine sand unit is absent in the area of the MW-4, MW-5 and MW-6 well locations. A fine to coarse sand unit overlies the fine sand unit, ranging in thickness from 0 to 90 feet in thickness. This unit is absent in the area of the MW-2, MW-4, MW-7, MW-8 and MW-10 well locations. The uppermost unit in the unconsolidated sediment is one of silts and clayey silts which can be found from 20 feet below ground surface up to the surface. The bedrock and soil geology, as described above, is illustrated in three cross sections that were prepared for the study area (Figure Nos. 4-15 through 4-17). Figure No. 4-14 illustrates the locations of the cross sections on a site map. Boring logs used to construct these cross sections are contained in Appendix D.

4.7 Ground Water Hydrology

4.7.1 Regional Ground Water Hydrology

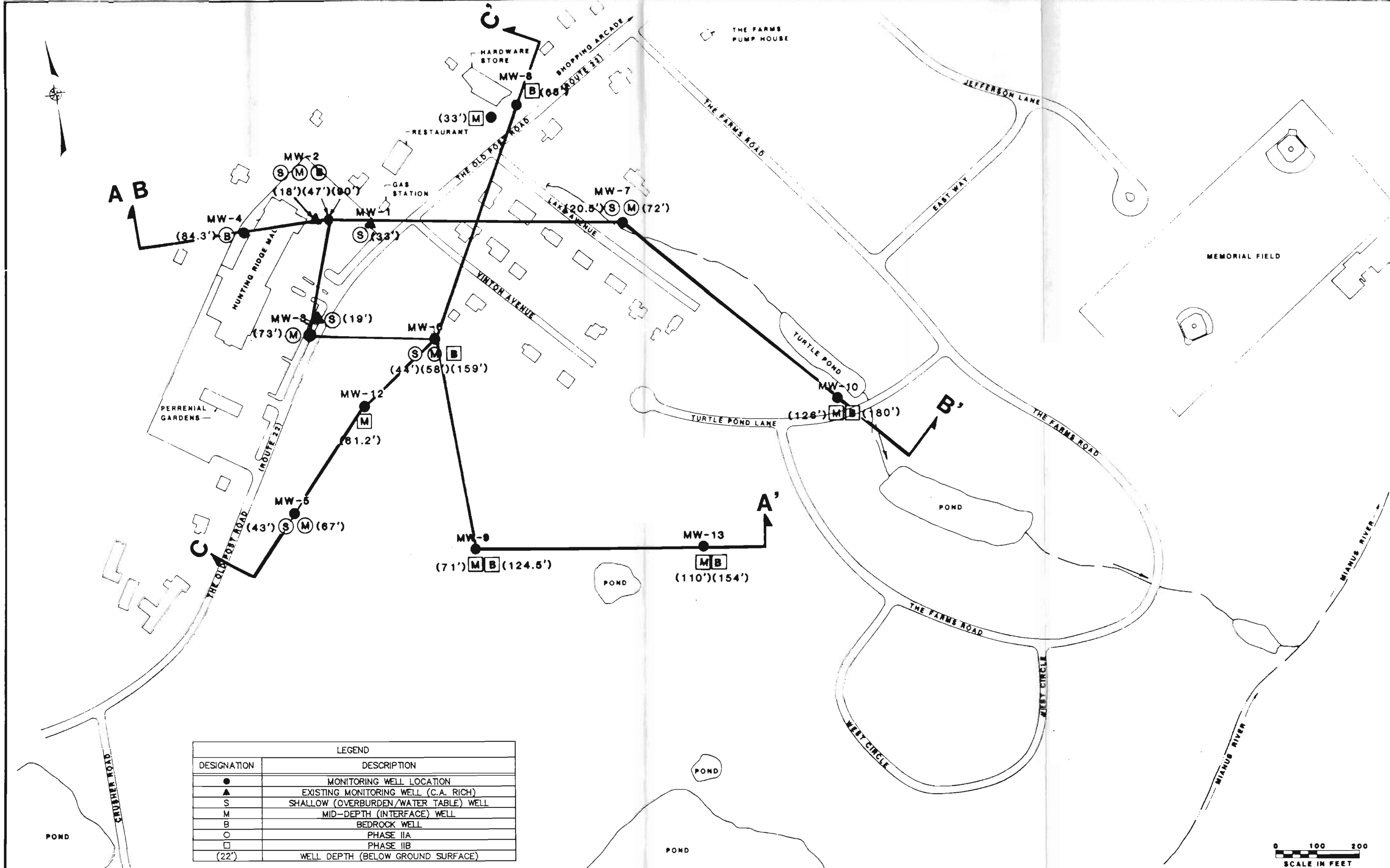
The following description of regional subsurface hydrology was obtained from the report prepared for the Town of Bedford by Leggette, Brashers and Graham, Inc. entitled "Ground Water Assessment - Town of Bedford, New York, December, 1985."

4.7.1.1 Bedrock Aquifers

The crystalline bedrock of Bedford consists of hard, relatively impermeable rock of metamorphic origin which has been extensively fractured as a result of tectonic deformation of the earth's crust.

Hydrogeologically, these rocks can be divided into two groups: one, the foliated silicates represented by Fordham and Bedford Gneisses and the Manhattan Formation, and two, the carbonate Inwood Marble. The first group commonly yields sufficient water for domestic supply. In areas of increased fracture density, these rocks may produce as much as 365 gallons per minute (gpm). In Westchester County as a whole, the Manhattan Schist is the most extensive and one of the most productive bedrock aquifers.

Gneiss is reported to yield small to moderate quantities of water throughout Westchester County and neighboring areas. Approximately 75 percent of Bedford is underlain by this rock type, making it the most aerially extensive aquifer by far. Only



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION
▲	EXISTING MONITORING WELL (C.A. RICH)
S	SHALLOW (OVERBURDEN/WATER TABLE) WELL
M	MID-DEPTH (INTERFACE) WELL
B	BEDROCK WELL
○	PHASE IIA
□	PHASE IIB
(22')	WELL DEPTH (BELOW GROUND SURFACE)

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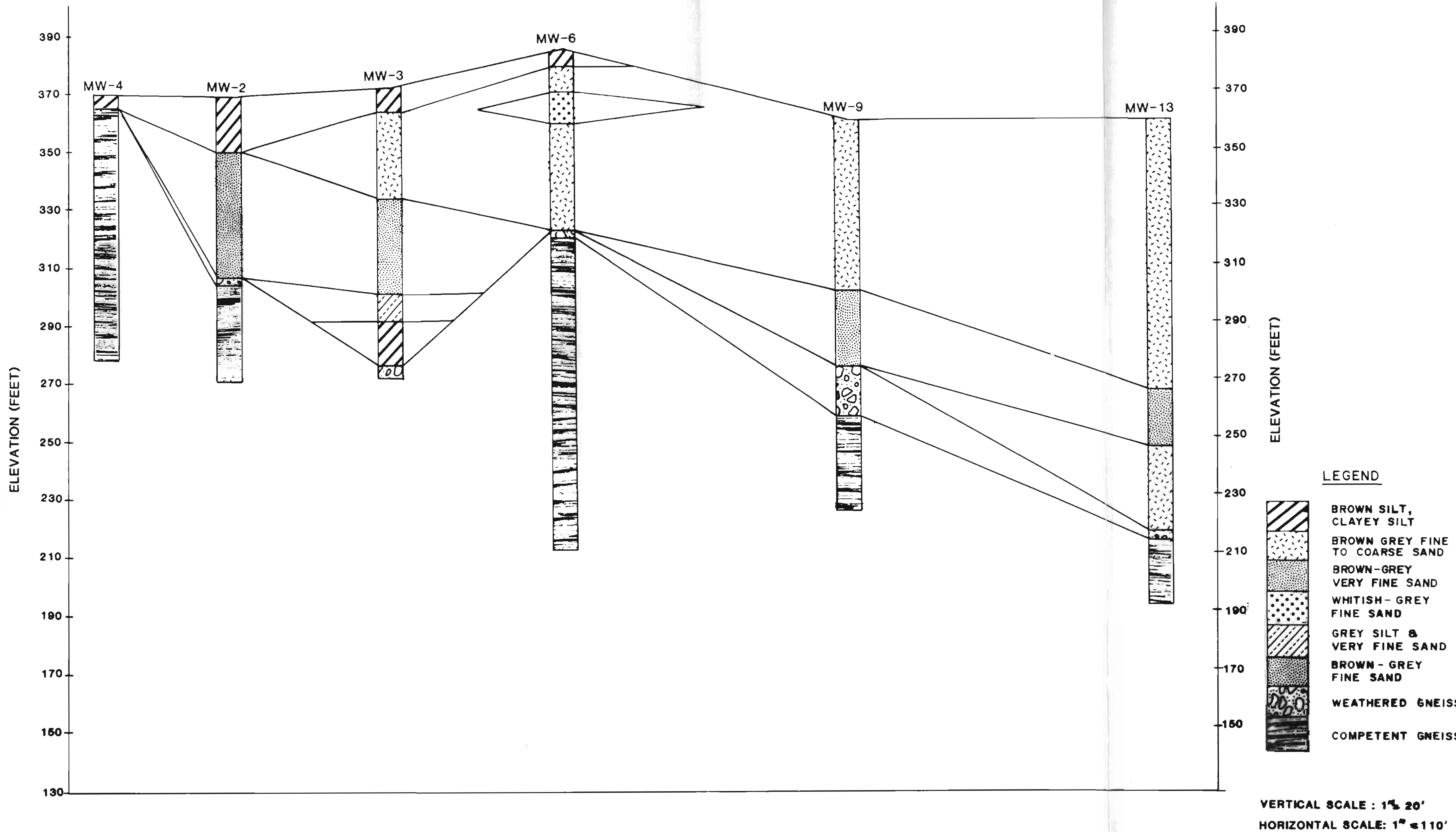
CONSULTING ENGINEERS
Syosset, New York

BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
LOCATIONS OF GEOLOGIC
CROSS SECTIONS

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 4-14



BEDFORD VILLAGE WELLS
HUNTING RIDGE MALL STUDY AREA

CROSS SECTION A-A

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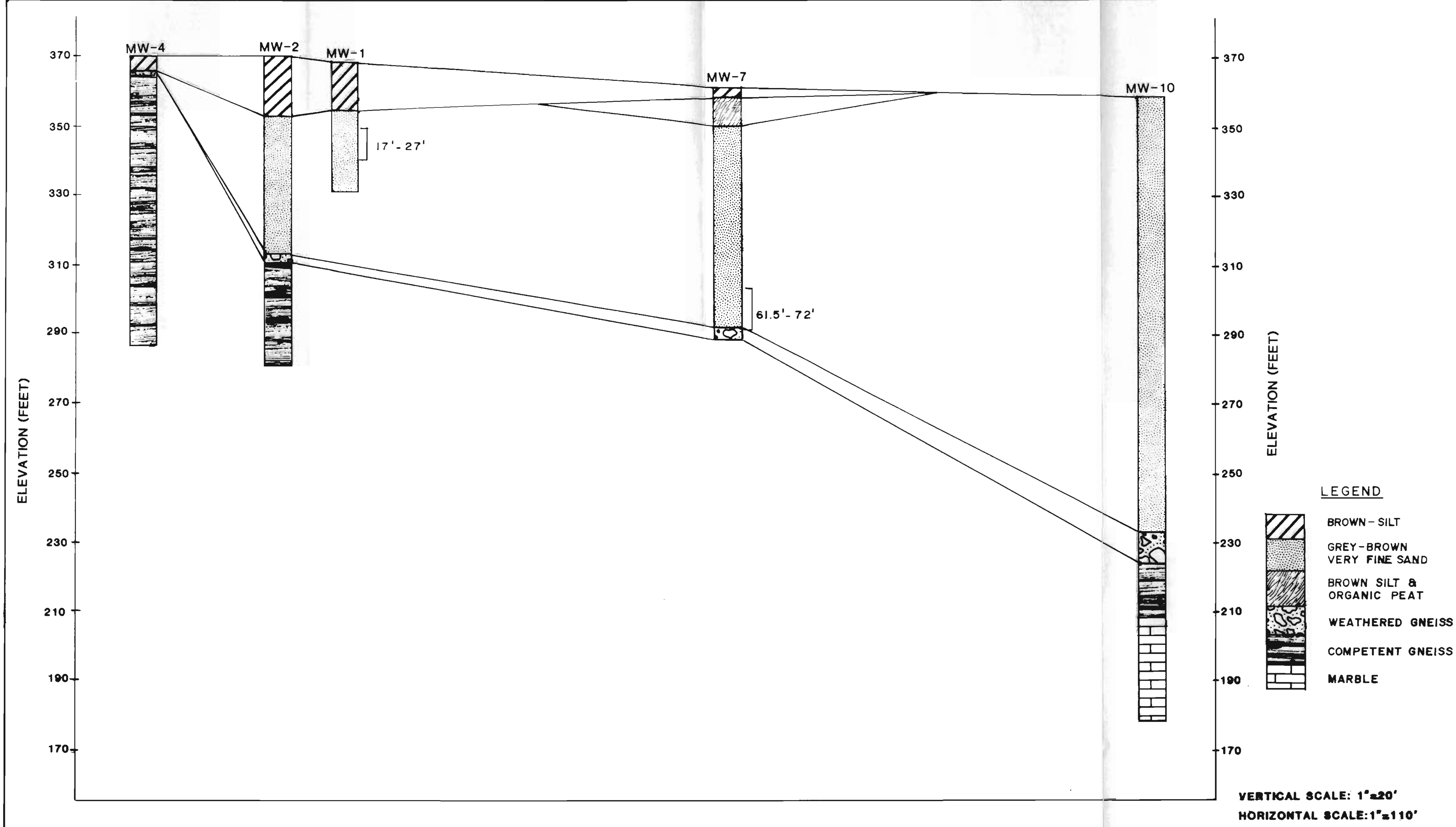
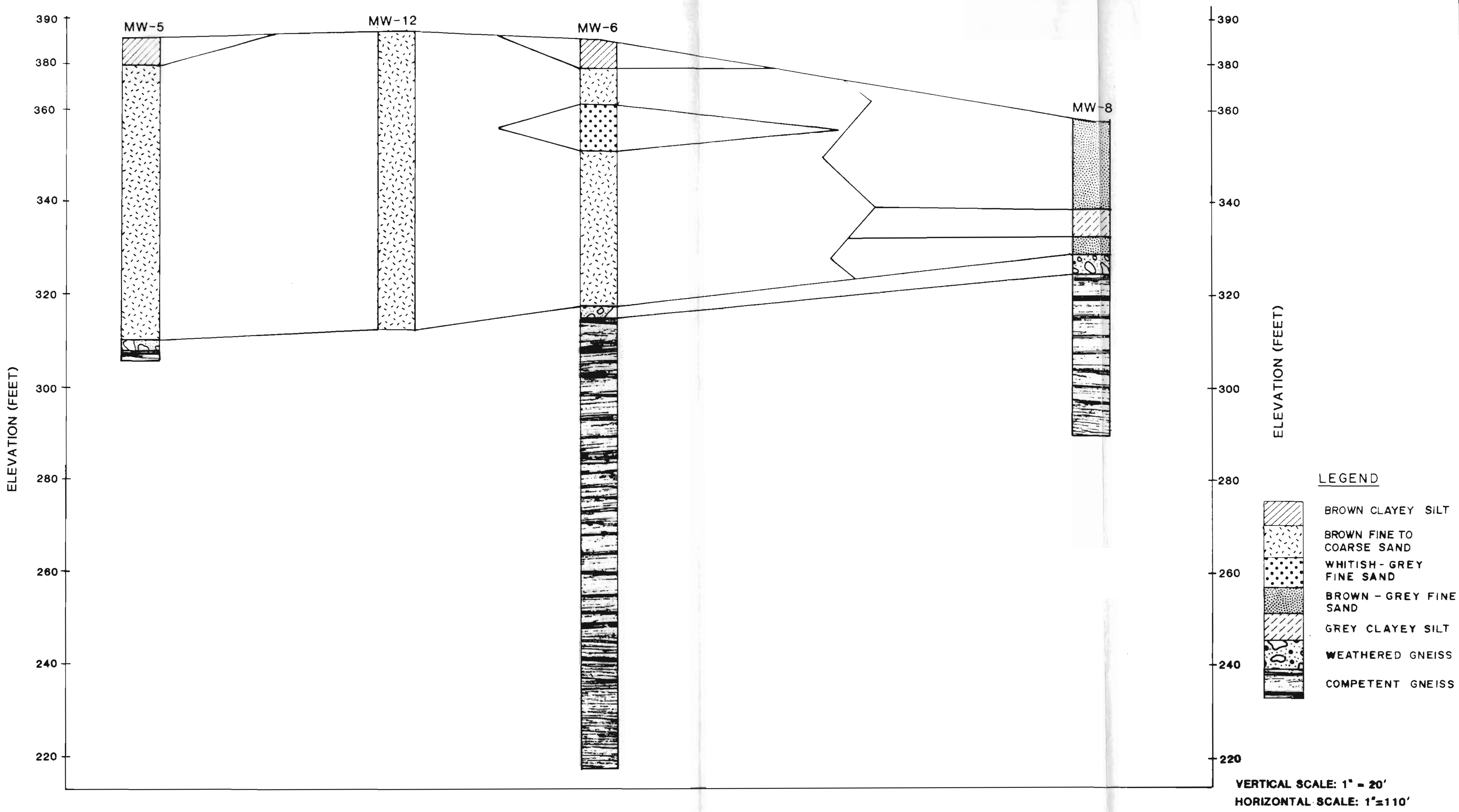
FIGURE NO. 4-15



BEDFORD VILLAGE WELLS
HUNTING RIDGE MALL STUDY AREA

CROSS SECTION B-B

FIGURE NO. 4-16



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BEDFORD VILLAGE WELLS
HUNTING RIDGE MALL STUDY AREA

CROSS SECTION C-C

FIGURE NO. 4-17

approximately 11 percent of the land in Bedford is underlain by Manhattan Formation Schist. Approximately 93 percent of the private residential water supply in Bedford is obtained from these rock types.

Although of limited extent, the carbonate rocks are known to yield large quantities of water in some areas. Inwood/Stockbridge Marble is the most productive bedrock aquifer in Westchester and Dutchess Counties. An average yield from Dutchess County wells completed in marble is reported to be 22 gpm, with a range from 0 to 220 gpm. Recent well yields in excess of 300 gpm have been achieved from the Inwood Marble in Somers and in Mount Pleasant. Because these rocks are soluble at ambient pressure and temperature, fractures tend to be chemically enlarged by most natural waters. This can improve the water storage and transmitting properties of the rock substantially. In Bedford, the Inwood Marble has undergone significant fracturing. Increased production can be expected where wells intersect openings along which solutioning has occurred.

Only four percent of the private wells surveyed in Bedford produce water from the Inwood Stockbridge Marble. An average reported yield of only 13 gpm probably reflects the fact that most of the wells were drilled no deeper than necessary to develop a domestic water supply well. In addition, because these rocks often underlie unconsolidated deposits in valleys and lowlands, the potential recharge to the marble is substantially greater than for the upland bedrock units.

4.7.1.2 Soil (Unconsolidated) Aquifers

Glacial till can provide adequate water supply for domestic use from large diameter dug wells placed in relatively thick till deposits. Significant aquifers may occur in stratified drift, where sand and gravel layers are of sufficient thickness and where a source of recharge exists. Stratified deposits exceeding 100 feet in thickness occur in the Stone Hill River Valley near Pitch Swamp, in the central portion of the Mount Kisco–Katonah corridor, in the Davis Brook lowland and at the outlet of Cross River Reservoir. Deposits which range from 50 to 100 feet are found in parts of the Mianus River and Stone Hill River Valleys. The most widespread stratified deposits are less than 50 feet thick. Extensive areas covered by these deposits occur along the Mianus and Stone Hill Rivers and within the Davis Brook drainage system. The narrow valley along the Mount Kisco–Katonah corridor is underlain along most of its length by deposits of less than 50 feet. Isolated lowlands and stream valleys throughout the Town of Bedford also contain minor stratified deposits.

The geographic distribution of stratified-drift deposits is controlled, in part, by the configuration of underlying bedrock. The Inwood Marble is less resistant to chemical weathering than the other rock types and is more easily eroded. In addition, a considerable amount of fracturing has occurred in all rocks of this area as the result of regional tectonic forces and post-glacial rebound. Fractured rock is readily removed by physical erosional processes. Prior to and during glaciation, areas of marble bedrock and zones of fracture in other rock types, were eroded to form stream valleys. During glacial retreat, melting ice released entrained rock and rock debris into streams and lakes at the margin of the glacier. This material partially filled the preformed valleys with stratified drift. In Bedford, several aquifers capable of supporting high-yielding wells occur within these deposits. Wells completed in stratified drift produce from six to 600 gpm, with an average yield of about 100 gpm.

4.7.2 Site Ground Water Hydrology

Throughout the well drilling program, water level elevations were obtained from the existing and constructed monitoring wells in the study area. The most comprehensive sets of data were obtained at the end of the field program (September 1, 1988 and November 8, 1988) when all the monitoring wells were completed. Water levels are an essential component to the hydrogeologic investigation because the slope of the water table indicates direction of ground water movement.

The ground water elevations for each monitoring well were plotted on the Hunting Ridge Mall Study Area base map. Ground water contours were mapped for the two general subsurface zones investigated (overburden and bedrock) utilizing triangulation and the pre-supposition that ground water flows from a higher to lower hydraulic head. Water level elevations recorded during the investigation for each of the dates for which they were obtained are provided in Table Nos. 4-5 through 4-8.

4.7.2.1 Bedrock Ground Water Flow

Ground water flow in bedrock can be an extremely complex process. The ground water flow in the metamorphic bedrock underlying the study area is characterized by fracture flow. Fracture flow can be effected by numerous factors such as fracture density, the interconnection of fractures and the pressures associated with the fluids within the fractures.

Table No. 4–5

GROUND WATER ELEVATIONS
December 21, 1987

(Measured in Feet)

Monitoring Well Number	Depth of Well Below Ground Surface	Depth to Ground Water (From Top of PVC Casing)	Well Elevation (Mean Sea Level) (Top of PVC Casing	Ground Water Elevation (Mean Sea Level)	Vertical Gradient (ft./ft.)
MW–1S	22.33	13.10	371.17	358.07	—
MW–2S	18.77	14.02	373.31	359.29	
MW–2M	67.50	14.47	372.58	358.11	0.02 (downward)
MW–2B	70.00	14.59	372.59	358.00	0.04 (downward)
MW–3S	19.00	16.48	374.09	357.61	
MW–3M	92.00	17.73	375.24	357.51	1.4×10^{-3} (downward)
MW–4B	39.50	6.06	372.22	366.66	—
MW–5S	43.58	29.93	387.52	357.59	
MW–5M	69.50	30.46	387.92	357.46	5.0×10^{-3} (downward)
MW–6S	44.50	33.60	390.46	356.87	
MW–6M	60.00	32.95	389.83	356.88	6.5×10^{-4} (upward)
MW–7S	22.00	6.71	363.64	356.93	
MW–7M	73.75	6.91	363.71	356.80	2.5×10^{-3} (downward)

Table No. 4–6

GROUND WATER ELEVATIONS
May 23, 1988

(Measured in Feet)

Monitoring Well Number	Depth of Well Below Ground Surface	Depth to Ground Water (From Top of PVC Casing)	Well Elevation (Mean Sea Level) (Top of PVC Casing	Ground Water Elevation (Mean Sea Level)	Vertical Gradient (ft./ft.)
MW–1S	33	11.20	371.17	359.97	—
MW–2S	18	12.37	373.31	360.94	
MW–2M	47	12.42	372.58	360.16	0.03 (downward)
MW–2B	90	12.71	372.59	359.88	6.5×10^{-3} (downward)
MW–3S	19	14.76	374.09	359.33	
MW–3M	73	16.16	375.24	359.08	4.6×10^{-3} (downward)
MW–4B	84.3	3.52	372.39	368.87	—
MW–5S	43	28.21	387.52	359.31	
MW–5M	67	28.74	387.92	359.18	5.4×10^{-3} (downward)
MW–6S	44	31.94	390.46	358.52	
MW–6M	58	31.44	389.83	358.39	9.3×10^{-3} (downward)
MW–7S	20.5	5.66	363.64	357.98	
MW–7M	72	5.69	363.71	358.02	7.8×10^{-4} (upward)
MW–8M*	33	8.83	368.05	359.22	—
MW–10M	126	1.99	359.96	357.97	
MW–10B	180	12.26	359.96	347.70	0.19 (downward)

*Undeveloped

Table No. 4–7

GROUND WATER ELEVATIONS
September 1, 1988

(Measured in Feet)

Monitoring Well Number	Depth of Well Below Ground Surface	Depth to Ground Water (From Top of PVC Casing)	Well Elevation (Mean Sea Level) (Top of PVC Casing	Ground Water Elevation (Mean Sea Level)	Vertical Gradient (ft./ft.)
MW–1S	33	13.76	371.17	357.41	—
MW–2S	18	15.28	373.31	358.03	
MW–2M	47	15.11	372.58	357.47	0.02 (downward)
MW–2B	90	15.21	372.59	357.38	2.1 x 10^{-3} (downward)
MW–3S	19	16.98	374.09	357.11	
MW–3M	73	18.30	375.24	356.94	3.1 x 10^{-3} (downward)
MW–4B	84.3	9.14	372.39	363.25	—
MW–5S	43	30.71	387.52	356.81	
MW–5M	67	31.16	387.92	356.76	2.1 x 10^{-3} (downward)
MW–6S	44	33.96	390.46	356.50	
MW–6M	58	33.45	389.83	356.38	8.6 x 10^{-3} (downward)
MW–6B	159	32.15	387.77	355.62	7.5 x 10^{-3} (downward)
MW–7S	20.5	7.55	363.64	356.09	
MW–7M	72	7.71	363.71	356.00	1.7 x 10^{-3} (downward)
MW–8M	33	10.96	368.05	357.09	
MW–8B	68	12.78	369.21	356.43	0.02 (downward)
MW–9M	71	8.48	363.92	355.44	
MW–9B	124.5	8.34	364.03	355.69	4.7 x 10^{-3} (upward)

Table No. 4–7 (continued)

GROUND WATER ELEVATIONS
September 1, 1988

(Measured in Feet)

Monitoring Well Number	Depth of Well Below Ground Surface	Depth to Ground Water (From Top of PVC Casing)	Well Elevation (Mean Sea Level) (Top of PVC Casing	Ground Water Elevation (Mean Sea Level)	Vertical Gradient (ft./ft.)
MW–10M	126	3.89	359.96	356.07	
MW–10B	180	3.43	359.96	356.53	8.5 x 10^{-3} (upward)
MW–12M	61.2	33.75	389.58	355.83	—
MW–13M	110	7.11	363.92	356.81	
MW–13B	154	16.30	364.03	347.73	0.21 (downward)

Table No. 4–8

GROUND WATER ELEVATIONS
November 8, 1988

(Measured in Feet)

Monitoring Well Number	Depth of Well Below Ground Surface	Depth to Ground Water (From Top of PVC Casing)	Well Elevation (Mean Sea Level) (Top of PVC Casing	Ground Water Elevation (Mean Sea Level)	Vertical Gradient (ft./ft.)
MW–1S	33	14.55	371.17	356.62	—
MW–2S	18	16.35	373.31	356.96	
MW–2M	47	15.91	372.58	356.67	0.01 (downward)
MW–2B	90	15.99	372.59	356.60	1.6×10^{-3} (downward)
MW–3S	19	17.84	374.09	356.25	
MW–3M	73	19.05	375.24	356.19	1.1×10^{-3} (downward)
MW–4B	84.3	10.35	372.39	362.04	—
MW–5S	43	31.35	387.52	356.17	
MW–5M	67	31.89	387.92	356.03	5.8×10^{-3} (downward)
MW–6S	44	34.60	390.46	355.86	
MW–6M	58	34.09	389.83	355.74	8.6×10^{-3} (downward)
MW–6B	159	32.74	387.77	355.03	7.0×10^{-3} (downward)
MW–7S	20.5	7.41	363.64	356.23	
MW–7M	72	7.95	363.71	355.76	9.1×10^{-3} (downward)
MW–8M	33	11.48	368.05	356.57	
MW–8B	68	13.08	369.21	356.13	0.01 (downward)
MW–9M	71	8.93	363.92	354.99	
MW–9B	124.5	8.84	364.03	355.19	3.7×10^{-3} (upward)

Table No. 4–8 (continued)

GROUND WATER ELEVATIONS
November 8, 1988

(Measured in Feet)

Monitoring Well Number	Depth of Well Below Ground Surface	Depth to Ground Water (From Top of PVC Casing)	Well Elevation (Mean Sea Level) (Top of PVC Casing	Ground Water Elevation (Mean Sea Level)	Vertical Gradient (ft./ft.)
MW–10M	126	4.15	359.96	355.81	
MW–10B	180	3.67	359.96	356.29	8.9×10^{-3} (upward)
MW–12M	61.2	34.40	389.58	355.18	—
MW–13M	110	16.34	363.92	347.58	
MW–13B	154	16.72	364.03	347.31	6.1×10^{-3} (downward)

To best characterize the general ground water flow direction in the bedrock underlying the study area, it is essential to obtain as many data points over a broad aerial extent as possible. In this way, ground water elevations in bedrock can be compared and a general trend noted.

Initially, bedrock ground water elevations were obtained from the three Phase IIA monitoring wells on May 23, 1988. Later in the Remedial Investigation, upon the completion of additional monitoring wells, ground water elevations were obtained at seven locations in the Hunting Ridge Mall Study Area on September 1, 1988 and November 8, 1988.

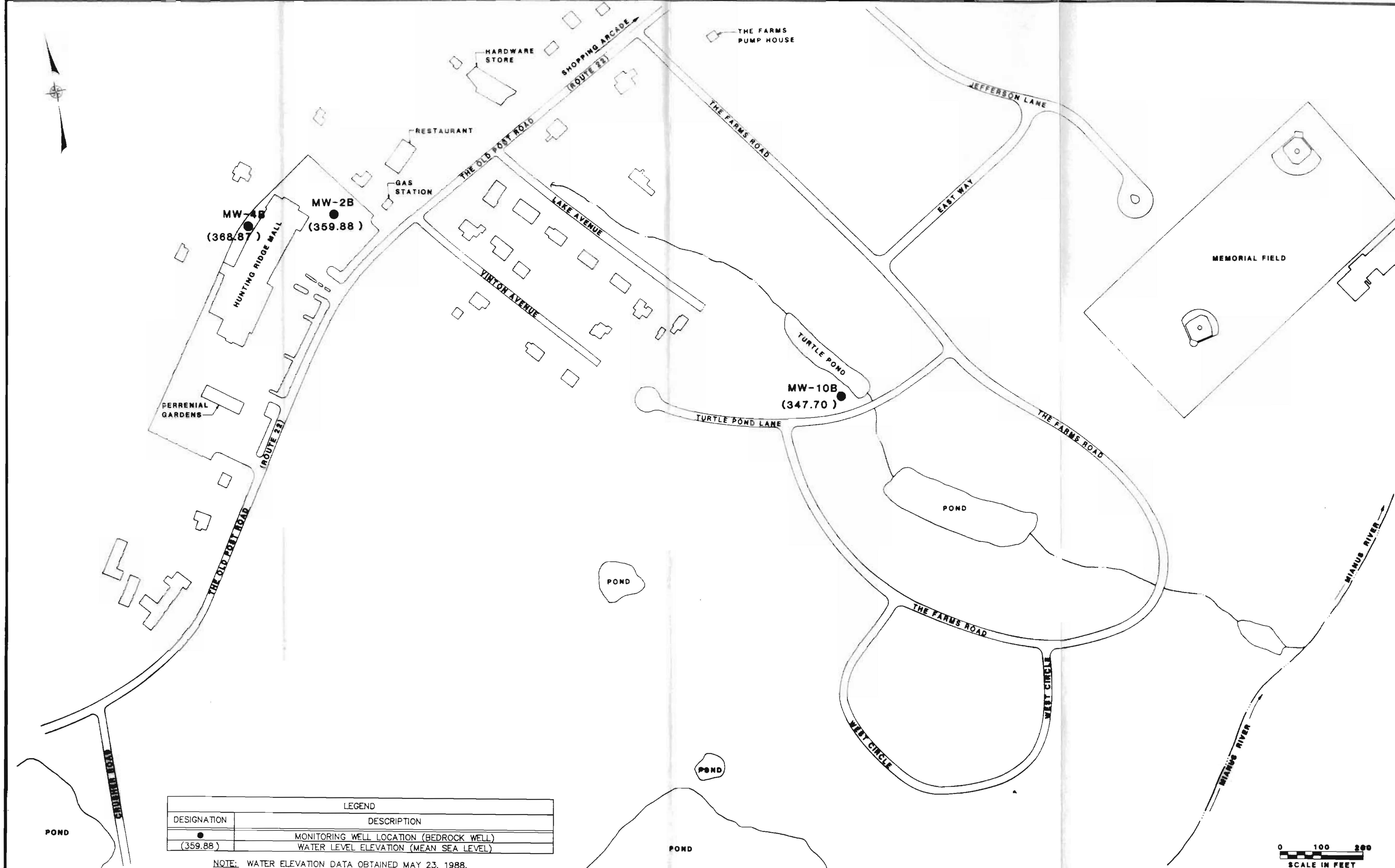
Generally, the ground water within the bedrock can be characterized as migrating horizontally in a southeasterly direction from the Hunting Ridge Mall towards the Mianus River (see Figure Nos. 4–18 through 4–20). The ground water gradient in the metamorphic bedrock zone underlying the study area is approximately 0.011–0.14 foot of head loss per foot of horizontal distance. Ground water is migrating downward through the unconsolidated deposits at the Hunting Ridge Mall Site and recharging bedrock. Vertical gradients range from 1.1×10^{-3} ft./ft. to 0.21 ft./ft.

4.7.2.2 Soil (Unconsolidated) Ground Water Flow

Measurements of water elevations in the unconsolidated deposits were obtained in December 1987, May 1988, September 1988 and November 1988 in the Hunting Ridge Mall Study Area (see Figure Nos. 4–21 through 4–24).

The ground water elevation measurements obtained during these four distinct periods all exhibit a general southeasterly flow from the Hunting Ridge Mall towards the Mianus River. The horizontal ground water gradient in the stratified drift deposits underlying the study area is approximately 0.0026–0.0038 foot of head loss per foot of horizontal distance. As mentioned in Section 4.7.2.1, ground water also migrates downward through the unconsolidated deposits and recharges bedrock as indicated by the vertical gradients ranging from 1.1×10^{-3} ft./ft. to 0.21 ft./ft.

It appears from the ground water elevation measurements (particularly on November 8, 1988) that the stream that runs parallel to Lake Avenue acts, at times, as a recharge zone to the stratified drift ground water system in the unconsolidated deposits (as well as possibly in the bedrock).



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION (BEDROCK WELL)
(359.88)	WATER LEVEL ELEVATION (MEAN SEA LEVEL)

NOTE: WATER ELEVATION DATA OBTAINED MAY 23, 1988.

NO.	DATE	REVISION	INT

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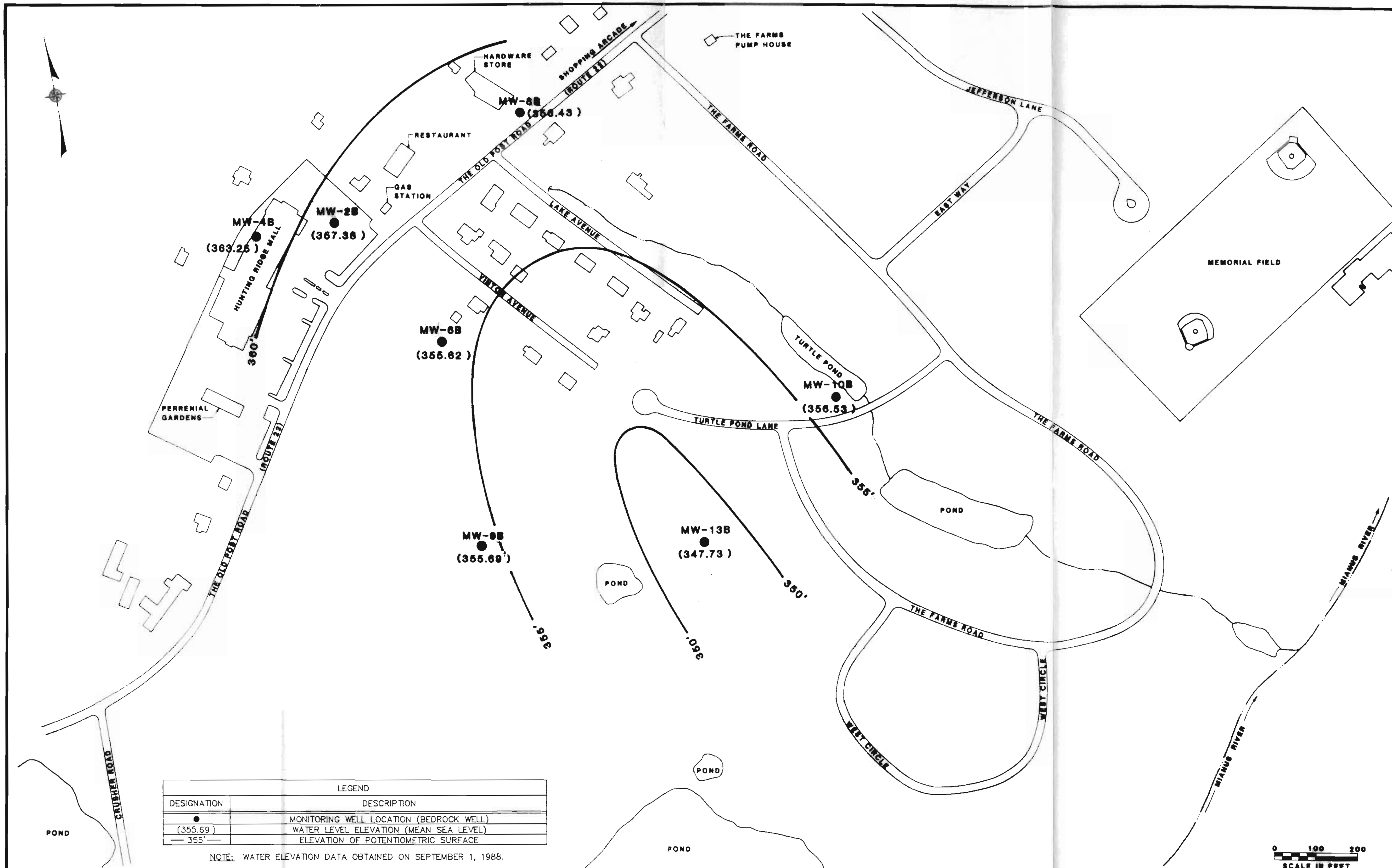
BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
BEDROCK WATER LEVEL MAP
MAY 23,1988

PROJECT NO. 842
DATE:
SCALE AS NOTED
FIGURE NO. 4-18



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION (BEDROCK WELL)
(355.69)	WATER LEVEL ELEVATION (MEAN SEA LEVEL)
— 355' —	ELEVATION OF POTENTIOMETRIC SURFACE

NOTE: WATER ELEVATION DATA OBTAINED ON SEPTEMBER 1, 1988.

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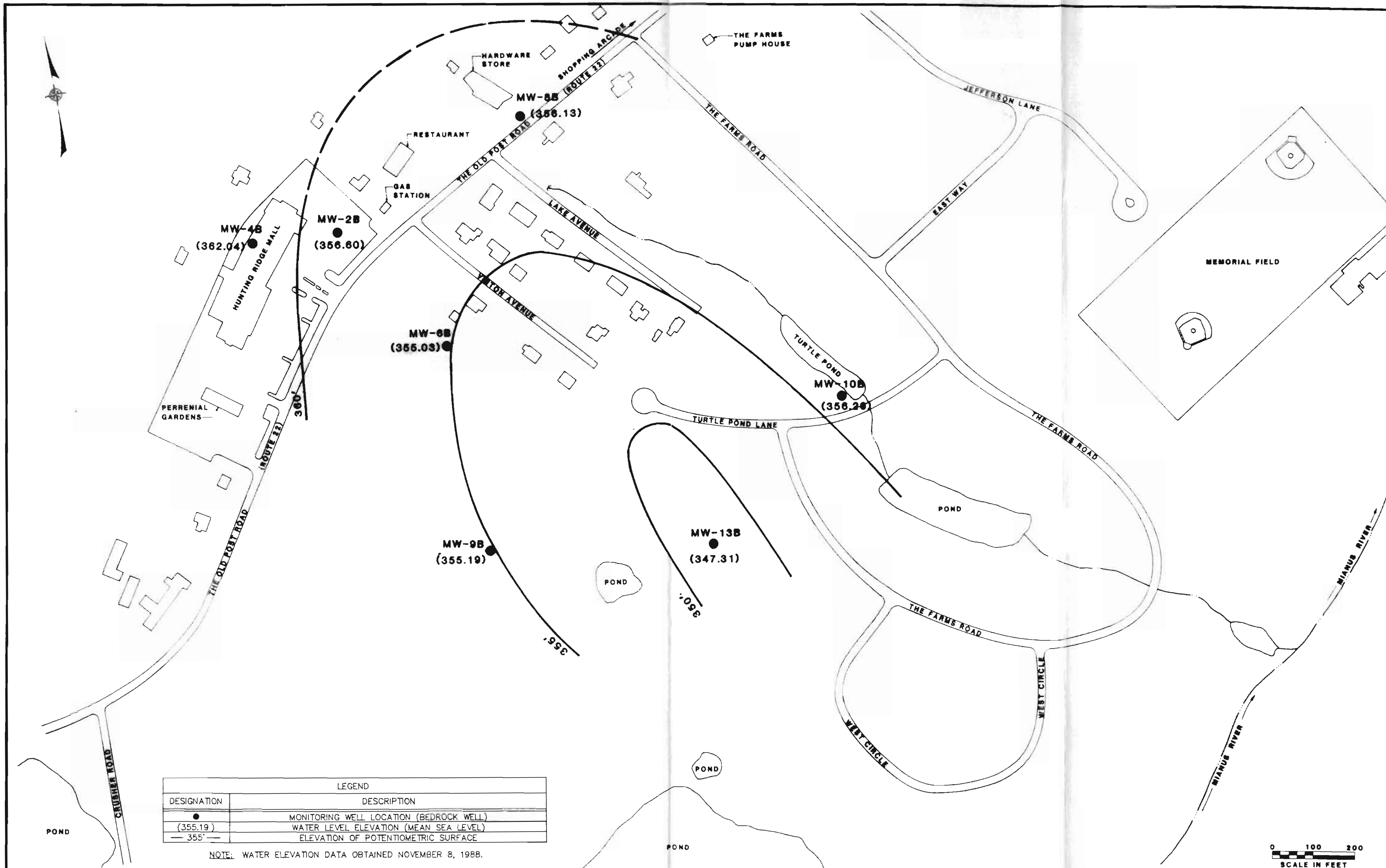
HUNTING RIDGE MALL STUDY AREA
BEDROCK WATER LEVEL MAP
SEPTEMBER 1,1988

PROJECT NO. 842	FIGURE NO. 4-19
DATE:	
SCALE: AS NOTED	



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION (BEDROCK WELL)
(355.19)	WATER LEVEL ELEVATION (MEAN SEA LEVEL)
— 355' —	ELEVATION OF POTENTIOMETRIC SURFACE

NOTE: WATER ELEVATION DATA OBTAINED NOVEMBER 8, 1988.

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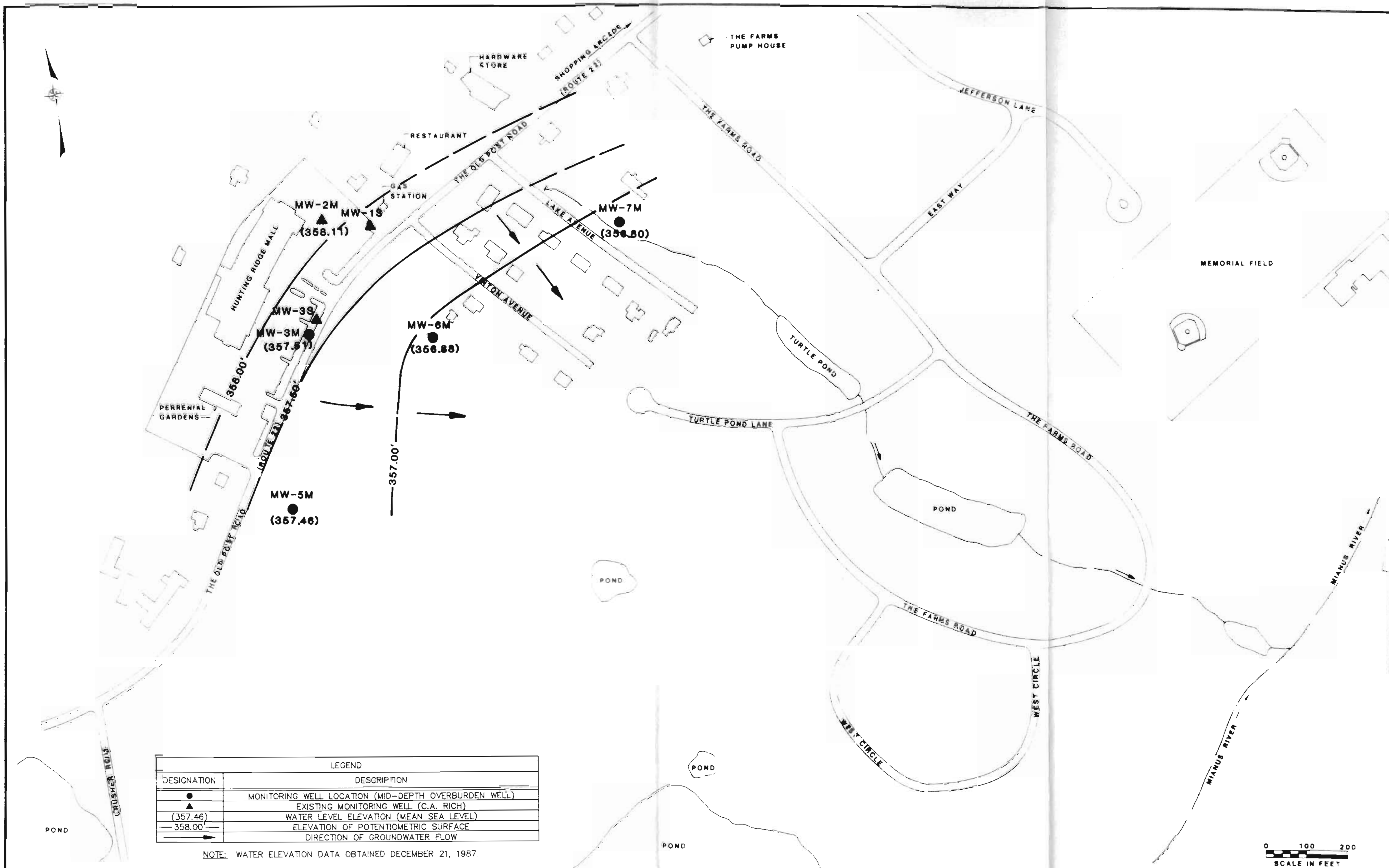
HUNTING RIDGE MALL STUDY AREA
BEDROCK WATER LEVEL MAP
NOVEMBER 8,1988

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 4-20



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION (MID-DEPTH OVERBURDEN WELL)
▲	EXISTING MONITORING WELL (C.A. RICH)
(357.46)	WATER LEVEL ELEVATION (MEAN SEA LEVEL)
— 358.00' —	ELEVATION OF POTENTIOMETRIC SURFACE
⟶	DIRECTION OF GROUNDWATER FLOW

NOTE: WATER ELEVATION DATA OBTAINED DECEMBER 21, 1987.

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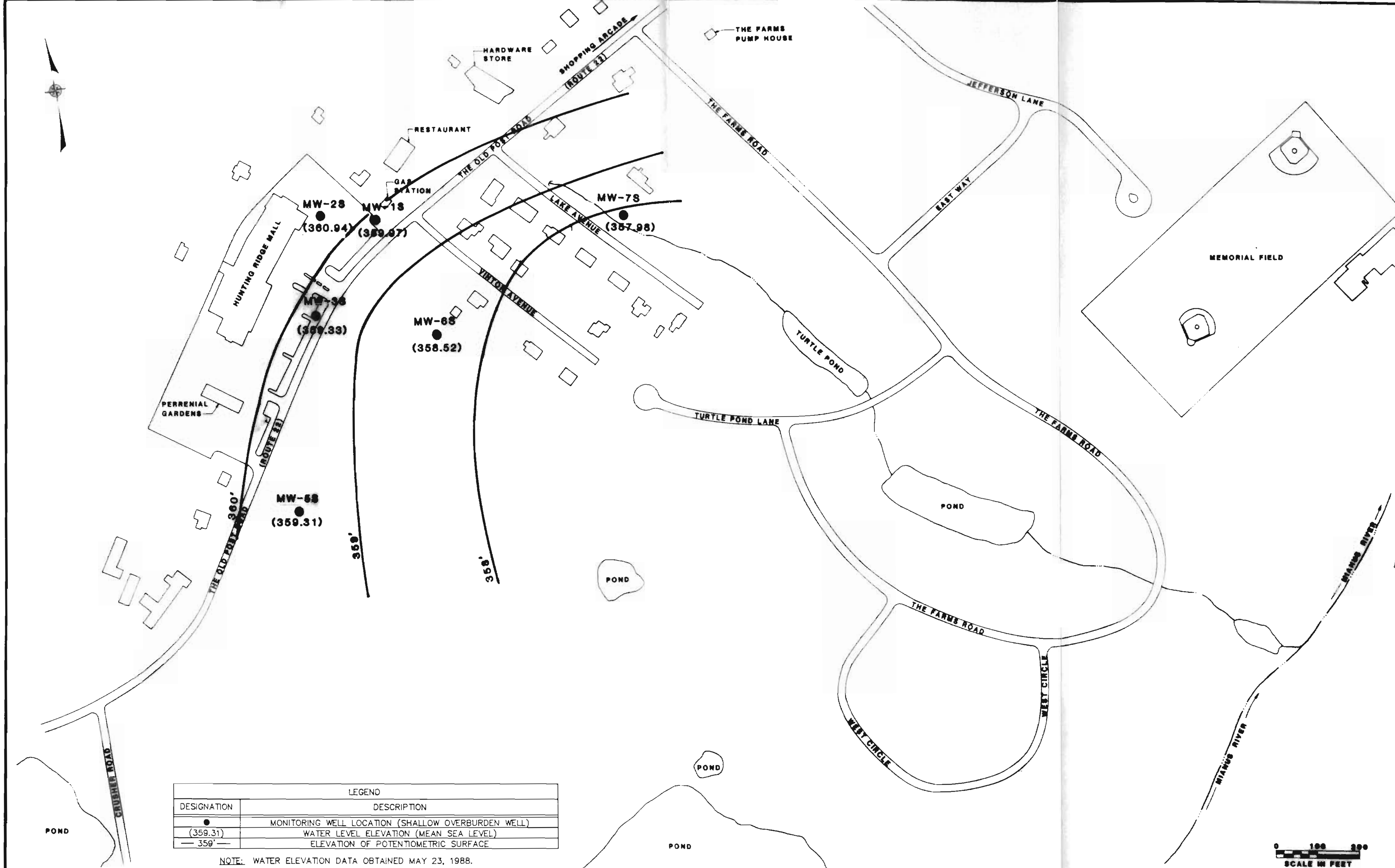
HUNTING RIDGE MALL STUDY AREA
WATER TABLE MAP
DECEMBER 21, 1987

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 4-21



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION (SHALLOW OVERBURDEN WELL)
(359.31)	WATER LEVEL ELEVATION (MEAN SEA LEVEL)
— 359' —	ELEVATION OF POTENTIOMETRIC SURFACE

NOTE: WATER ELEVATION DATA OBTAINED MAY 23, 1988.

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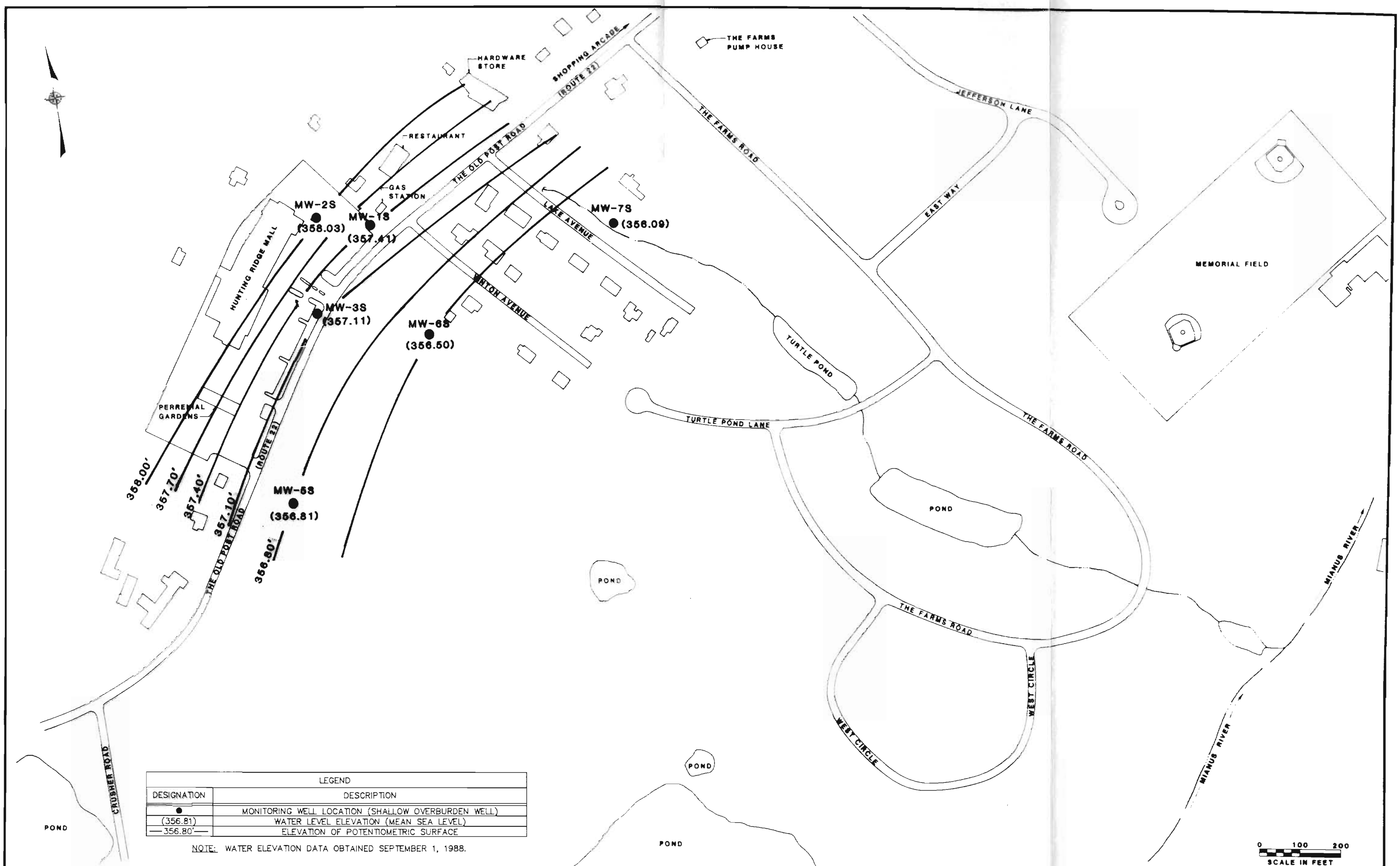
HUNTING RIDGE MALL STUDY AREA
WATER TABLE MAP
MAY 23,1988

PROJECT NO. 842
DATE:
SCALE: AS NOTED

FIGURE NO. 4-22



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION (SHALLOW OVERBURDEN WELL)
(356.81)	WATER LEVEL ELEVATION (MEAN SEA LEVEL)
—356.80'—	ELEVATION OF POTENTIOMETRIC SURFACE

NOTE: WATER ELEVATION DATA OBTAINED SEPTEMBER 1, 1988.

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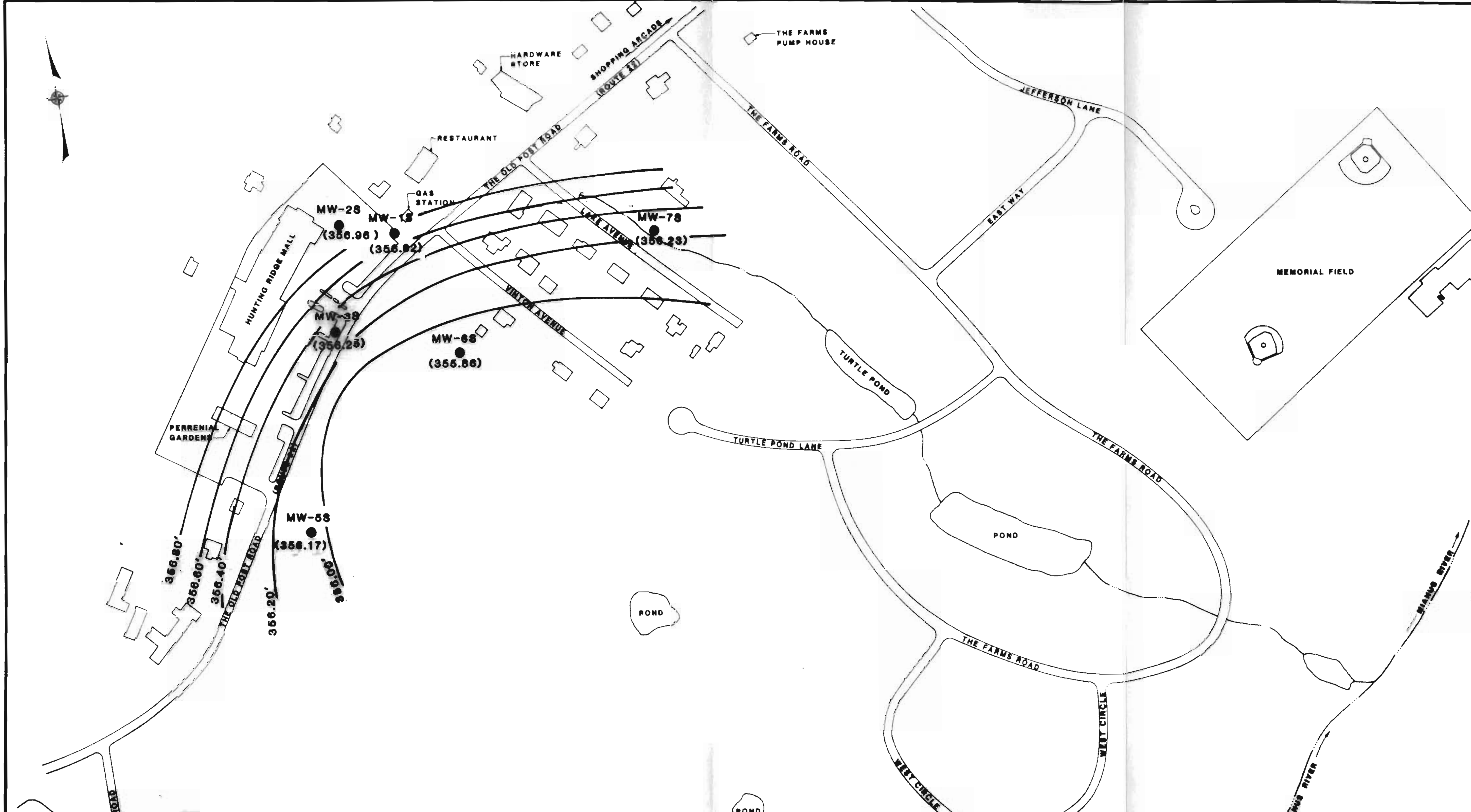
HUNTING RIDGE MALL STUDY AREA
WATER TABLE MAP
SEPTEMBER 1,1988

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO. 4-23



LEGEND	
DESIGNATION	DESCRIPTION
●	MONITORING WELL LOCATION (SHALLOW OVERBURDEN WELL)
(356.17)	WATER LEVEL ELEVATION (MEAN SEA LEVEL)
—356.00'—	ELEVATION OF POTENTIOMETRIC SURFACE

NOTE: WATER ELEVATION DATA OBTAINED NOVEMBER 8, 1988.

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WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
WATER TABLE MAP
NOVEMBER 8,1988

PROJECT NO.: 842
DATE:
SCALE: AS NOTED
FIGURE NO. 4-24

Section 5

5.0 WATER SUPPLY SAMPLING PROGRAM

The purpose of this section of the Remedial Investigation Report is to describe the basis, institution and proceedings of the Water Supply (Tap Water) Sampling Program, present the analytical results of the samples which were obtained during this program, and discuss their relation and significance to the most current applicable drinking water and ambient ground water standards.

5.1 Description of the Water Supply Sampling Program

5.1.1 Purpose of the Sampling Program

As a result of concern expressed by the residents regarding the quality of water supply in the study area and at the request of the New York State Department of Environmental Conservation (NYSDEC), a comprehensive Water Supply Sampling Program was designed for the Hunting Ridge Mall Study Area to supplement the originally planned Remedial Investigation. The intent of the Water Supply Sampling Program was to:

- Obtain analytical data to determine the levels of drinking water contamination in the private water supply wells and one community water supply well in the study area in order to address public health concerns.

- Obtain analytical data to confirm and/or supplement the existing historical data obtained and compiled from previous water supply sampling efforts by the United States Environmental Protection Agency (USEPA) and the Westchester County Department of Health (WCDH), and review this data for the purpose of evaluating trends in water supply contamination.

- Obtain analytical data from the private water supply wells to supplement the data from the monitoring well (ground water) sampling program in order to determine and define the magnitude and aerial extent of ground water contamination by volatile organic compounds (VOCs) and other Hazardous Substance List (HSL) constituents in the study area. The evaluation of the data would assist in determining where and how the analytes of concern are moving through the ground water and determine and/or confirm possible sources and migration routes of contamination.

- Obtain analytical data and utilize the results to assist in determining and designing additional future phases of the ground water and water supply sampling programs, if necessary.

- Obtain analytical data and utilize the results to assist in determining and designing a definitive remedial action in the future, if required.

Once the concept of this program was approved by NYSDEC, a detailed work plan was prepared for undertaking the sampling program. After the work plan was approved, the sampling program was implemented.

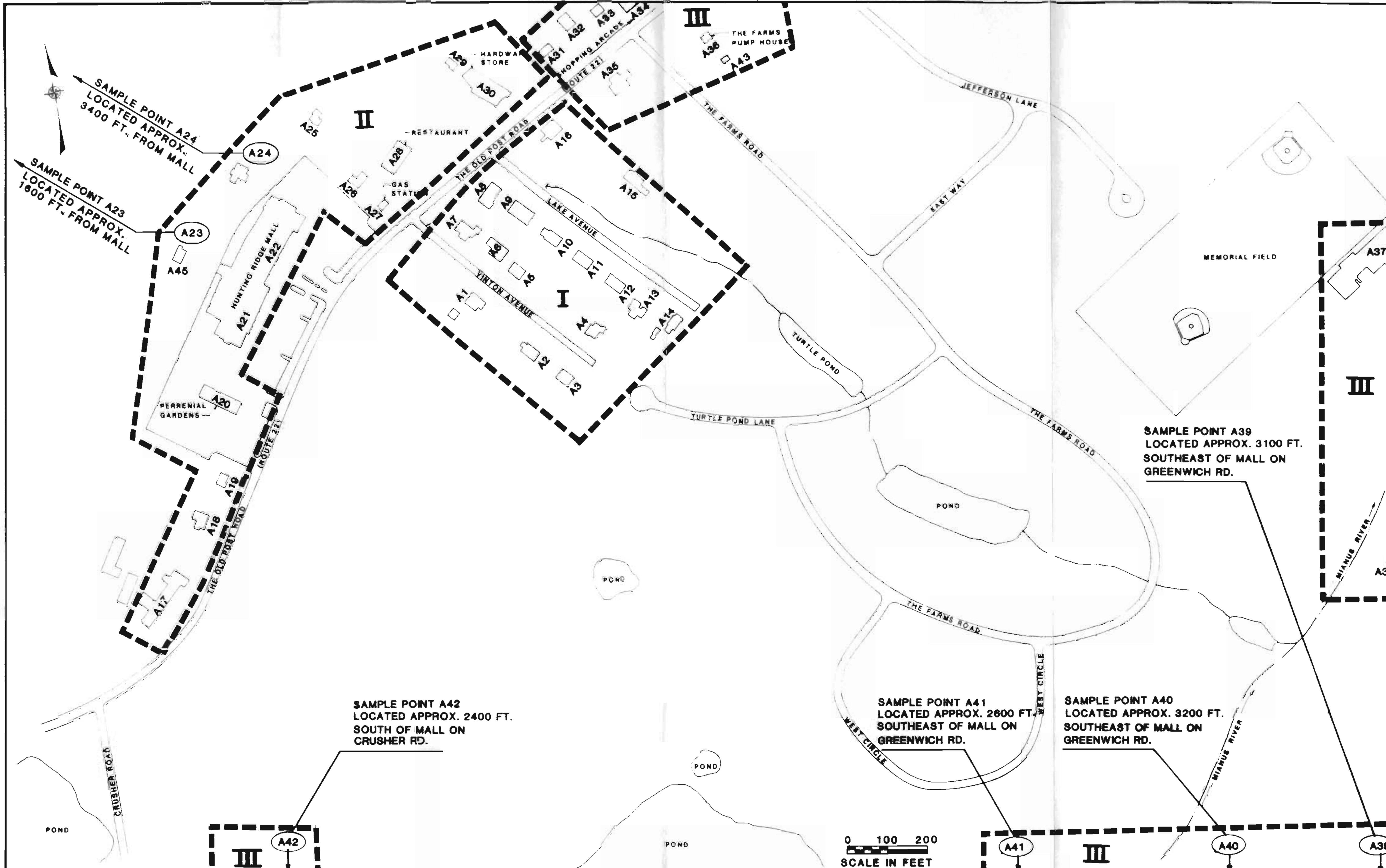
5.1.2 Implementation of the Sampling Program

Prior to the implementation of the actual field sampling portion of the Water Supply Sampling Program, permission request forms were mailed (return receipt requested) to all property owners in order to obtain permission to gain access to their property and collect samples. Follow-up telephone conversations with each property owner or tenant were conducted in order to arrange a convenient time for sample collection. A planning matrix was prepared for implementing the sampling program to ensure optimum organization and coordination of field work by providing orderly arrangement and scheduling of sampling dates and times most convenient to the property owners, as well as the types of analyses that were to be performed and the number of samples to be collected. A planning/ implementation matrix included the following information that was obtained for each sampling point/location:

- Sampling section in which sampling point is located.
- Owner name and address of property/sampling point.
- Owner mailing address (if different)
- Tax map number (section and lot)
- Location map number
- Telephone number of owner
- Date that request letter was sent, date of certified receipt and date that request letter was received.
- Approval to sample (yes or no)
- Most appropriate date and time to sample
- Types of analyses to be performed and number of samples to be obtained
- Remarks

Figure No. 5-1 is a detailed map of the Hunting Ridge Mall Study Area illustrating the locations of each sampling point and sampling sector. The number and specific location of each residential unit and commercial establishment sampled is identified in one of three sampling sectors/zones. These sampling sectors were devised for the purpose of achieving optimum efficiency in the scheduling and performance of daily sampling. Water supply sampling was scheduled and samples were collected at all of the sampling points except for the following locations for the reasons indicated.

Sample Location #	Address	Owner
o #A10	9 Lake Avenue	Royston Lockyer
Reason: Sampling permission denied.		
o #A19	40 Old Post Road (Real Estate Office)	Jefferson Israel, D.V.M.
Reason: Building (A19) supplied by adjacent Village Veterinary Hospital (A18). Sample collected at A18.		
o #A22	Hunting Ridge Mall 420–422 Old Post Road	B&B Auto Parts, Inc. c/o Pasquale J. Amico, Esq.
Reason: Serviced by same well as sample location A21. Sample collected at A21.		
o #A27	452 Old Post Road (Shorco Gas Station)	Jeanette R. Stuke
Reason: No water supply service at building		
o #A31	472 Old Post Road	The Capital Company c/o Michael Dignelli
Reason: No access to house, residents not present. Outdoor hose bib/spigot not functioning, water supply not accessible.		



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WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
WATER SUPPLY SAMPLING PROGRAM
SAMPLING LOCATIONS

PROJECT NO. 842
DATE
SCALE AS NOTED
FIGURE NO 5-1

In addition, the locations of samples obtained for A23 and A24 were relocated approximately 1,600 feet northwest and 3,400 feet northwest of the Hunting Ridge Mall, respectively, and sampling point A45 was located upgradient directly behind the Mall. Another sampling point, A43, was added because A36 (The Farms Pump [Well] House) was initially inaccessible. However, permission to sample A36 was eventually obtained, but only after A43 had already been sampled and analyzed.

In total, there were 38 locations sampled including residential homes and business establishments. At these locations there were a total of 40 samples collected and analyzed for VOCs and another 44 samples tested for nitrates. Also, an additional six samples (IIC[M]A3D, IIC[M]A4D, IIC[M]36D and resample of 36D and IIC[M]43D) were obtained and analyzed for the HSL constituents. The HSL analysis was selected for those samples that were collected from sampling points that were located in close proximity to potential source(s) of contamination and/or for samples taken from a water supply well that serves a large number of people in the community. Nitrate samples were obtained as an indicator of sewage contamination.

In addition, there were five locations that contained granular activated carbon (GAC) treatment units. All five of these locations were private residences that utilized GAC filter units for water purification. With regard to sampling at residential homes and/or business establishments that contained GAC units, two samples were obtained for each parameter to be tested by sampling before and after the treatment units.

5.1.3 Sampling Procedures

The water supply sampling procedures implemented as originally outlined in the sampling protocol work plan, were as follows:

1. Fill out Tap Water Sampling Program Sample Information Record.

2. Remove the laboratory pre-cleaned sample bottles from sample cooler, label bottles with a water proof marker, make note of any water purification or conditioning systems, holding tanks, etc. on the Sample Information Record Form and complete the sample Chain-of-Custody Form.

3. If there is a treatment system, identify a location to sample (if possible) that is ahead of the in-line water purification/conditioning device. If samples are to be collected from a faucet, disassemble aeration screen and/or terminal purification system that may be on the faucet (if possible). Note these conditions of the Sample Information Record Form.

4. Allow the water to run for approximately five minutes to adequately flush the line before sampling.

5. Collect the water directly in the sample bottles taking care not to spill sample on outside of bottle or overfill bottle. For volatile organic samples, make sure that air bubbles are not in the sample vial after it has been capped.

6. Return the sample bottle to cooler.

7. Close the sampling point ahead of the treatment device and reassemble screens and/or water purification/conditioning systems that may have been removed during sample collection.

Please note that samples were taken before and after GAC units when the existing plumbing permitted doing so. In all cases where GAC units were present, valves were accessible and samples were collected before and after the units without jeopardizing the integrity of the plumbing.

Daily Quality Control Reports were completed for each day of field work. These forms summarized the work that was performed each day, the results of field analysis, and problems encountered and resolutions. Chain-of-Custody Forms provided by the laboratory contracted to perform the analytical services were completed for each sample transaction.

5.1.4 Analytical Methods

The analytical methods that were used for sample testing were in accordance with the 1986 NYSDEC Contract Laboratory Protocol (CLP). Samples collected for HSL metal analyses were not filtered and were preserved in the field with nitric acid, as required by NYSDEC.

Provision was made for field and trip blanks, matrix spikes and matrix spike duplicates. In accordance with NYSDEC protocol, a complete Quality Assurance/Quality Control program was instituted and was based on the following guidelines:

- o One field blank per day of sampling – VOC
- o One trip blank per sample pick-up – VOC
- o One matrix spike liquid HSL per 20 samples
- o One matrix spike duplicate liquid HSL per 20 samples
- o One matrix spike liquid VOC per 20 samples
- o One matrix spike duplicate liquid VOC per 20 samples

5.2 Analytical Results of the Water Supply Sampling Program

The purpose of this section of the report is to present the analytical results of the samples which were obtained during the water supply/tap water sampling program.

Table No. 5–1 lists the analytical results for those samples analyzed for organic compounds. Figure No. 5–2 summarizes and presents the results of each organic compound detected that is an analyte of concern. Analytes of concern are the same as those defined for the monitoring well/ground water sampling program described in Section 4.0, above, these being tetrachloroethene (designated PCE), trichloroethene (designated TCE), 1,2–dichloroethene (designated 1,2–DCE), 1,1,1–trichloroethane (designated 1,1,1–TCA), benzene, toluene and xylene. Other compounds detected included chlorobenzene (designated Chloroben), and 2–butanone (designated 2–Butan) or methyl ethyl ketone.

Tables Nos. 5–2 and 5–3 provide the results of the samples analyzed for inorganic constituents, namely metals and nitrate–nitrogen, respectively. It should be noted that for the HSL analyses, all results for semi–volatiles and pesticides/PCBs were non–detectable except for typical laboratory contaminants such as Bis (2–ethylhexyl) phthalate.

5.2.1 Results of Samples Analyzed for Organic Compounds

The data presented in Table No. 5–1 indicates that organic chemical contamination was detected at approximately 66% of all of the sampling points (25 of 38 locations). The results show that the most commonly found parameters and analytes of concern were

Table No. 5-1
BEDFORD WATER SUPPLY SAMPLING PROGRAM
HUNTING RIDGE MALL
WATER SUPPLY ANALYTICAL RESULTS FOR ORGANIC COMPOUNDS **

PARAMETERS	IIC(M)A1D 10/24/88 9 Vinton*	IIC(M)A2DB 10/24/88 17 Vinton	IIC(M)A2DA 10/24/88 17 Vinton	IIC(M)A3D 10/24/88 21 Vinton*	IIC(M)A3I 10/24/88 21 Vinton	IIC(M)A4D 10/25/88 20 Vinton*	IIC(M)A5D 10/24/88 12 Vinton	IIC(M)A6D 10/24/88 8 Vinton	IIC(M)A7D 10/24/88 2 Vinton
Methylene Chloride	2.0 JB								
Acetone									
Carbon Disulfide					1.0 J				
Trichloroethene									
Tetrachloroethene		22.0		3.0 J	58.0	2.0 J	11.0	4.0 J	
1,1,1-Trichloroethane									
Benzene			3.0 J						
Chloroform									
1,1-Dichloroethene									
Toluene	2.0 J		5.0						
Chlorobenzene						2.0 J			
1,1-Dichloroethane									
Chloromethane									
Bromomethane									
Chloroethane									
1,2-Dichloroethene(Total)		6.0			5.0	5.0	5.0		
1,2-Dichloroethane									
2-Butanone									
Carbon Tetrachloride									
Vinyl Acetate									
Bromodichloromethane									
1,2-Dichloropropane									
Cis-1,3-Dichloropropene									
Dibromochloromethane									
1,1,2-Trichloroethane									
Trans-1,3-Dichloropropene									
Bromoform									
4-Methyl-2-Pentanone									
2-Hexanone									
1,1,2,2-Tetrachloroethane									
Ethylbenzene									
Styrene									
Xylene(Total)			4.0 J		2.0 J				
Bis(2-Ethylhexyl)Phthalate	2.0 JB			2.0 JB		3.0 JB			

Table No. 5-1 (continued)

PARAMETERS	IIC(M)A8DB 10/25/88 381 Old Post	IIC(M)A8DA 10/25/88 381 Old Post	IIC(M)A9DB 10/26/88 5 Lake	IIC(M)A9DA 10/26/88 5 Lake	IIC(M)A11DB 10/25/88 13 Lake	IIC(M)A11DA 10/25/88 13 Lake	IIC(M)A12D 10/25/88 17 Lake	IIC(M)A12DMS 10/25/88 17 Lake	IIC(M)A12DMSD 10/25/88 17 Lake
Methylene Chloride		2.0 J			4.0 J			2.0 J	
Acetone									
Carbon Disulfide						0.8 J			
Trichloroethene									
Tetrachloroethene	17.0		3.0 J		10.0		1.0 J	1.0 J	2.0 J
1,1,1-Trichloroethane									
Benzene						0.7 J			
Chloroform									
1,1-Dichloroethene									
Toluene									
Chlorobenzene									
1,1-Dichloroethane									
Chloromethane									
Bromomethane									
Chloroethane									
1,2-Dichloroethene(Total)			3.0 J		13.0		8.0	8.0	8.0
1,2-Dichloroethane									
2-Butanone								3.0 J	0.9 J
Carbon Tetrachloride									
Vinyl Acetate									
Bromodichloromethane									
1,2-Dichloropropane									
Cis-1,3-Dichloropropene									
Dibromochloromethane									
1,1,2-Trichloroethane									
Trans-1,3-Dichloropropene									
Bromoform									
4-Methyl-2-Pentanone									
2-Hexanone									
1,1,2,2-Tetrachloroethane									
Ethylbenzene									
Styrene									
Xylene(Total)									

Table No. 5-1 (continued)

PARAMETERS	IIC(M)A13D 10/25/88 21 Lake	IIC(M)A14DB 10/24/88 25 Lake	IIC(M)A14DA 10/24/88 25 Lake	IIC(M)A15D 10/25/88 12 Lake	IIC(M)A16D 10/25/88 391 Old Post	IIC(M)A17D 10/27/88 402 Old Post	IIC(M)A18D 10/26/88 406 Old Post	IIC(M)A20D 10/26/88 414 Old Post	IIC(M)A20I 10/26/88 414 Old Post
Methylene Chloride	2.0 J			3.0 J			2.0 JB	2.0 JB	
Acetone									
Carbon Disulfide									
Trichloroethene	1.0 J					1.0 J			
Tetrachloroethene		45.0						12.0	
1,1,1-Trichloroethane									
Benzene									
Chloroform									
1,1-Dichloroethene									
Toluene	1.0 J					1.0 J			
Chlorobenzene	0.8 J			0.5 J				3.0 J	
1,1-Dichloroethane									
Chloromethane									
Bromomethane									
Chloroethane									
1,2-Dichloroethene(Total)									
1,2-Dichloroethane									
2-Butanone	0.7 J								
Carbon Tetrachloride									
Vinyl Acetate									
Bromodichloromethane									
1,2-Dichloropropane									
Cis-1,3-Dichloropropene									
Dibromochloromethane									
1,1,2-Trichloroethane									
Trans-1,3-Dichloropropene									
Bromoform									
4-Methyl-2-Pentanone									
2-Hexanone									
1,1,2,2-Tetrachloroethane									
Ethylbenzene									
Styrene									
Xylene(Total)									

Table No. 5-1 (continued)

PARAMETERS	IIC(M)A21D 10/31/88 420 Old Post#	IIC(M)A23D 10/27/88 416 Old Post	IIC(M)A24D 10/27/88 418 Old Post	IIC(M)A25D 10/27/88 450 Old Post	IIC(M)A26D 10/25/88 452 Old Post	IIC(M)A28D 10/27/88 454 Old Post	IIC(M)A29D 10/26/88 464 Old Post	IIC(M)A30D 10/28/88 466 Old Post	IIC(M)A32D 10/26/88 476 Old Post
Methylene Chloride					3.0 J	4.0 JB			
Acetone									
Carbon Disulfide							1.0 J		
Trichloroethene			3.0 J						
Tetrachloroethene	27.0		6.0			15.0			
1,1,1-Trichloroethane									
Benzene									
Chloroform									
1,1-Dichloroethene									
Toluene					1.0 J				
Chlorobenzene									
1,1-Dichloroethane									
Chloromethane									
Bromomethane									
Chloroethane									
1,2-Dichloroethene(Total)	5.0				2.0 J	5.0		3.0 J	
1,2-Dichloroethane									
2-Butanone				1.0 J	0.6 J				
Carbon Tetrachloride									
Vinyl Acetate									
Bromodichloromethane									
1,2-Dichloropropane									
Cis-1,3-Dichloropropene									
Dibromochloromethane									
1,1,2-Trichloroethane									
Trans-1,3-Dichloropropene									
Bromoform									
4-Methyl-2-Pentanone									
2-Hexanone									
1,1,2,2-Tetrachloroethane									
Ethylbenzene									
Styrene									
Xylene(Total)		4.0 J			9.0				
Bis(2-Ethylhexyl)Phthalate	2.0 JB								
Diethylphthalate	2.0 J								

Table No. 5-1 (continued)

PARAMETERS	IIC(M)A33D 10/26/88 480 Old Post	IIC(M)A33I 10/26/88 480 Old Post	IIC(M)A33IMS 10/26/88 480 Old Post	IIC(M)A33IMSD 10/26/88 480 Old Post	IIC(M)A34D 11/7/88 484 Old Post	IIC(M)A35D 10/25/88 399 Old Post	IIC(M)A36D 10/27/88 6 The Farms	IIC(M)A36D 10/31/88 6 The Farms*	IIC(M)A36D 11/2/88 6 The Farms*
Methylene Chloride	4.0 JB					2.0 J	2.0 JB		
Acetone					20.0 B				
Carbon Disulfide									
Trichloroethene						3.0 J			
Tetrachloroethene						4.0 J			
1,1,1-Trichloroethane	9.0	5.0	5.0	5.0					
Benzene						0.4 J			
Chloroform									
1,1-Dichloroethene									
Toluene	1.0 J					0.9 J	1.0 J		
Chlorobenzene									
1,1-Dichloroethane									
Chloromethane									
Bromomethane									
Chloroethane									
1,2-Dichloroethene(Total)									
1,2-Dichloroethane									
2-Butanone									
Carbon Tetrachloride									
Vinyl Acetate									
Bromodichloromethane									
1,2-Dichloropropane									
Cis-1,3-Dichloropropene									
Dibromochloromethane								2.0 J	
1,1,2-Trichloroethane									
Trans-1,3-Dichloropropene									
Bromoform								4.0 J	
4-Methyl-2-Pentanone									
2-Hexanone									
1,1,2,2-Tetrachloroethane									
Ethylbenzene									
Styrene									
Xylene(Total)									
Bis(2-Ethylhexyl)Phthalate								2.0 JB	0.8 JB
Diethylphthalate									2.0 J

Table No. 5-1 (continued)

PARAMETERS	IIC(M)A38D 11/2/88 129 Greenwich	IIC(M)A39D 10/28/88 165 Greenwich	IIC(M)A40D 10/26/88 179 Greenwich	IIC(M)A41D 10/27/88 207 Greenwich	IIC(M)A42D 10/27/88 Crusher	IIC(M)A43D 10/27/88 12 The Farms*	IIC(M)A45D 3/3/89 Sunnyfield
Methylene Chloride							
Acetone							
Carbon Disulfide	1.0 J						
Trichloroethene							
Tetrachloroethene							
1,1,1-Trichloroethane							
Benzene							
Chloroform							
1,1-Dichloroethene							
Toluene							
Chlorobenzene							
1,1-Dichloroethane							
Chloromethane							
Bromomethane							
Chloroethane							
1,2-Dichloroethene(Total)							
1,2-Dichloroethane							
2-Butanone							
Carbon Tetrachloride							
Vinyl Acetate							
Bromodichloromethane						2.0 J	
1,2-Dichloropropane							
Cis-1,3-Dichloropropene							
Dibromochloromethane							
1,1,2-Trichloroethane							
Trans-1,3-Dichloropropene							
Bromoform						4.0 J	
4-Methyl-2-Pentanone							
2-Hexanone							
1,1,2,2-Tetrachloroethane							
Ethylbenzene							
Styrene	0.9 J						
Xylene(Total)							
Bis(2-Ethlyhexyl)Phthalate						2.0 JB	

Table No. 5-1 (continued)

PARAMETERS	Field Blank 10/24/88	Field Blank 10/25/88	Field Blank 10/26/88	Trip Blank 10/26/88	Field Blank 10/27/88	Trip Blank 3/3/89	Field Blank 3/3/89
Methylene Chloride	4.0 J	5.0 B	2.0 JB	2.0 JB		3.0 J	
Acetone							
Carbon Disulfide							
Trichloroethene							
Tetrachloroethene							
1,1,1-Trichloroethane							
Benzene	0.8 J						
Chloroform	1.0 JB						
1,1-Dichloroethene							
Toluene	0.8 J	2.0 J					
Chlorobenzene							
1,1-Dichloroethane							
Chloromethane							
Bromomethane							
Chloroethane							
1,2-Dichloroethene(Total)							
1,2-Dichloroethane							
2-Butanone							
Carbon Tetrachloride							
Vinyl Acetate							
Bromodichloromethane							
1,2-Dichloropropane							
Cis-1,3-Dichloropropene							
Dibromochloromethane							
1,1,2-Trichloroethane							
Trans-1,3-Dichloropropene							
Bromoform							
4-Methyl-2-Pentanone							
2-Hexanone							
1,1,2,2-Tetrachloroethane							
Ethylbenzene							
Styrene							
Xylene(Total)							

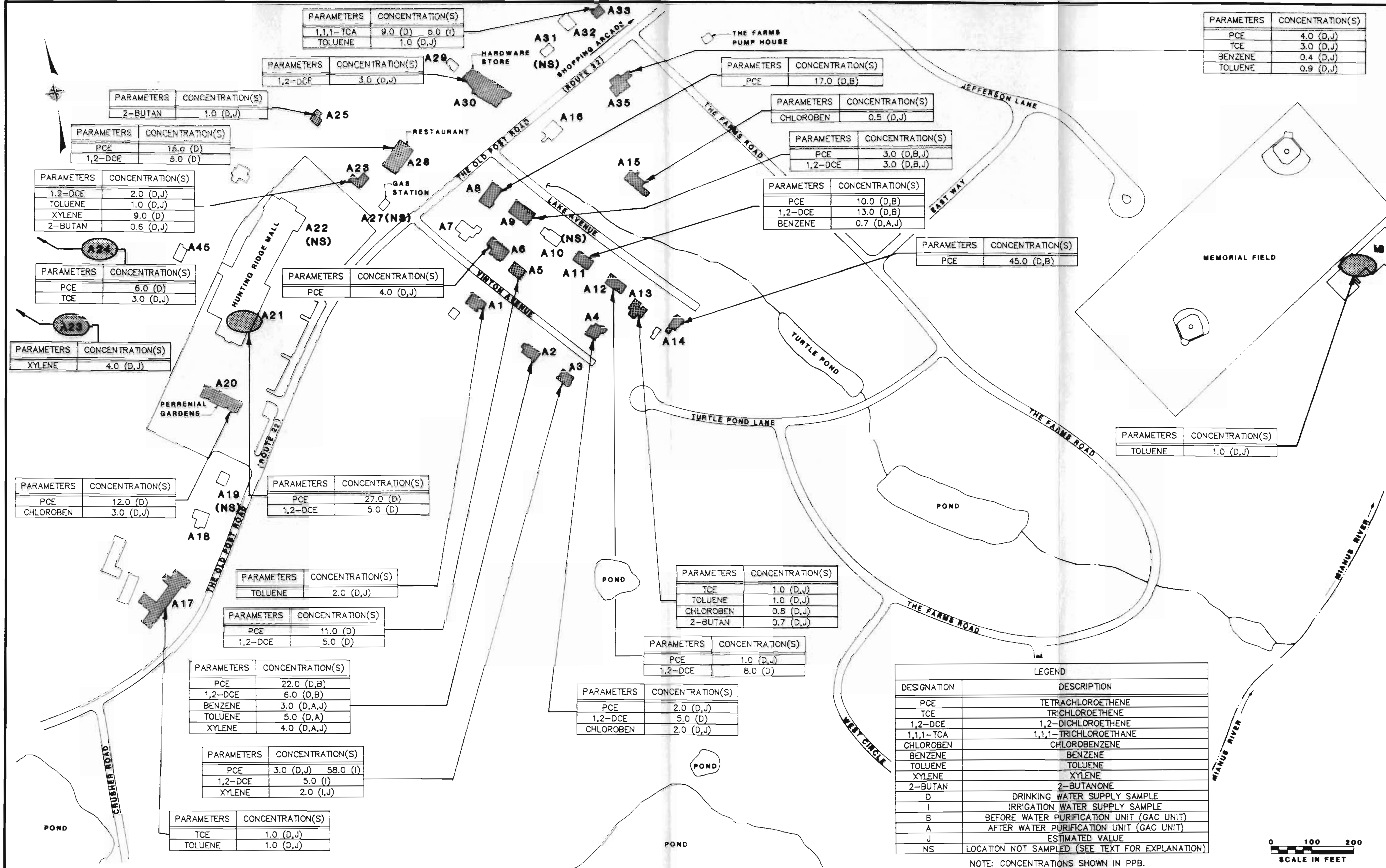
Note: Blank spaces in columns and rows indicate that concentrations of parameters shown were non-detectable.

Analyte Result Flags

J - Indicates estimated value.
B - This compound was found in the method blank as well as in the sample.
* - This sample was analyzed for full Target Compound List.
** - All concentrations shown in ug/l.

Sample Number Flags

D - Drinking water
I - Irrigation water
B - Before water purification unit
A - After water purification unit



PARAMETERS	CONCENTRATION(S)
1,1,1-TCA	9.0 (D) 5.0 (I)
TOLUENE	1.0 (D,J)

PARAMETERS	CONCENTRATION(S)
1,2-DCE	3.0 (D,J)

PARAMETERS	CONCENTRATION(S)
2-BUTAN	1.0 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	16.0 (D)
1,2-DCE	5.0 (D)

PARAMETERS	CONCENTRATION(S)
1,2-DCE	2.0 (D,J)
TOLUENE	1.0 (D,J)
XYLENE	9.0 (D)
2-BUTAN	0.6 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	6.0 (D)
TCE	3.0 (D,J)

PARAMETERS	CONCENTRATION(S)
XYLENE	4.0 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	4.0 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	12.0 (D)
CHLOROBEN	3.0 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	27.0 (D)
1,2-DCE	5.0 (D)

PARAMETERS	CONCENTRATION(S)
TOLUENE	2.0 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	11.0 (D)
1,2-DCE	5.0 (D)

PARAMETERS	CONCENTRATION(S)
PCE	22.0 (D,B)
1,2-DCE	6.0 (D,B)
BENZENE	3.0 (D,A,J)
TOLUENE	5.0 (D,A)
XYLENE	4.0 (D,A,J)

PARAMETERS	CONCENTRATION(S)
PCE	3.0 (D,J) 58.0 (I)
1,2-DCE	5.0 (I)
XYLENE	2.0 (I,J)

PARAMETERS	CONCENTRATION(S)
TCE	1.0 (D,J)
TOLUENE	1.0 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	17.0 (D,B)

PARAMETERS	CONCENTRATION(S)
CHLOROBEN	0.5 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	3.0 (D,B,J)
1,2-DCE	3.0 (D,B,J)

PARAMETERS	CONCENTRATION(S)
PCE	10.0 (D,B)
1,2-DCE	13.0 (D,B)
BENZENE	0.7 (D,A,J)

PARAMETERS	CONCENTRATION(S)
PCE	45.0 (D,B)

PARAMETERS	CONCENTRATION(S)
PCE	4.0 (D,J)
TCE	3.0 (D,J)
BENZENE	0.4 (D,J)
TOLUENE	0.9 (D,J)

PARAMETERS	CONCENTRATION(S)
TOLUENE	1.0 (D,J)

PARAMETERS	CONCENTRATION(S)
TCE	1.0 (D,J)
TOLUENE	1.0 (D,J)
CHLOROBEN	0.8 (D,J)
2-BUTAN	0.7 (D,J)

PARAMETERS	CONCENTRATION(S)
PCE	1.0 (D,J)
1,2-DCE	8.0 (D)

PARAMETERS	CONCENTRATION(S)
PCE	2.0 (D,J)
1,2-DCE	5.0 (D)
CHLOROBEN	2.0 (D,J)

LEGEND

DESIGNATION	DESCRIPTION
PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE
1,2-DCE	1,2-DICHLOROETHENE
1,1,1-TCA	1,1,1-TRICHLOROETHANE
CHLOROBEN	CHLOROBENZENE
BENZENE	BENZENE
TOLUENE	TOLUENE
XYLENE	XYLENE
2-BUTAN	2-BUTANONE
D	DRINKING WATER SUPPLY SAMPLE
I	IRRIGATION WATER SUPPLY SAMPLE
B	BEFORE WATER PURIFICATION UNIT (GAC UNIT)
A	AFTER WATER PURIFICATION UNIT (GAC UNIT)
J	ESTIMATED VALUE
NS	LOCATION NOT SAMPLED (SEE TEXT FOR EXPLANATION)

NOTE: CONCENTRATIONS SHOWN IN PPB.

NO	DATE	REVISION	INT

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW

PROJECT ENGINEER	DRAWN BY
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BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
WATER SUPPLY SAMPLING PROGRAM
SAMPLING LOCATIONS AND RESULTS

PROJECT NO. 842
DATE
SCALE AS NOTED

FIGURE NO. 5-2

Table No. 5-2
BEDFORD WATER SUPPLY SAMPLING PROGRAM
HUNTING RIDGE MALL
WATER SUPPLY ANALYTICAL RESULTS FOR METALS *

METALS

PARAMETERS	IIC(M)A1D		IIC(M)A3D		IIC(M)A4D		IIC(M)A21D		IIC(M)A36D		IIC(M)A43D	
Aluminum	55.8	B	30.6	U	30.6	U	101.0	B	141.0		30.6	U
Antimony	22.0	U	22.0	U	22.0	U	22.0	U	22.0	U	22.0	U
Arsenic	1.0	BN	1.0	UN	1.0	UN	1.0	UN	1.0	UN	1.0	UN
Barium	23.5	B	14.6	U	17.3	B	51.4	B	83.7	B	84.1	B
Beryllium	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Cadmium	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
Calcium	14,600		37,800		12,300		30,500		40,600		41,200	
Chromium	3.5	U	3.5	U	3.5	U	3.5	U	3.5	U	3.5	U
Cobalt	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
Copper	27.2		14.3	U	31.2		413.0		14.3	U	14.3	U
Iron	95.2	B	97.4	B	69.7	B	114.0		62.7	U	62.7	U
Lead	0.8	B	0.6	B	1.2	B	0.9	BN	0.4	BN	0.5	BN
Magnesium	4,440		7,920		16,100		7,620		11.700		11,900	
Manganese	3.6	U	3.6	U	3.6	U	6.7	B	3.6	U	3.6	U
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U
Potassium	1,050		3,150		31,000		3,020		4,180		4,160	U
Selenium	1.6	B	1.2	BN	1.2	BN	1.0	BN	1.2	BN	1.9	BNW
Silver	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U
Sodium	4,440		6,140		111,000		7,220		18,700		19,300	
Thallium	1.0	UN	1.0	UN	1.0	UN	1.0	UN	1.1	BN	1.0	UN
Vanadium	4.5	B	3.3	U	3.3U		4.9	B	3.3	U	3.3	U
Zinc	19.8	B	41.5		111.0		7.5	B	9.8	B	7.8	B
Cyanide(mg/l)	(0.005		(0.005		0.005		(0.005		0.039		(0.005	

* - All concentrations shown in ppb unless otherwise noted.

Analyte Result Flag:
- J - Indicates estimated value.
- B - This compound was found in the method blank as well as in the sample.
- U - Indicates that the compound was analyzed for but not detected.
- N - Spike sample recovery not within control Limits.

Analyte Number Flag:
- D - Drinking water

Table No. 5-3
BEDFORD WATER SUPPLY SAMPLING PROGRAM
HUNTING RIDGE MALL
WATER SUPPLY ANALYTICAL RESULTS FOR NITRATE-NITROGEN *

Sample Identification	Nitrate-Nitrogen Concentration
IIC(M)A1D	0.89
IIC(M)A2DA	5.40
IIC(M)A2DB	5.52
IIC(M)A3D	0.72
IIC(M)A4D	2.84
IIC(M)A5D	3.01
IIC(M)A6D	2.97
IIC(M)A7D	3.24
IIC(M)A8DA	2.21
IIC(M)A8DB	2.57
IIC(M)A9DA	1.18
IIC(M)A9DB	<0.10
IIC(M)A11DA	4.70
IIC(M)A11DB	4.24
IIC(M)A12D	1.43
IIC(M)A13D	7.35
IIC(M)A14DA	7.11
IIC(M)A14DB	9.27
IIC(M)A15D	1.26
IIC(M)A16D	1.28
IIC(M)A17D	4.56
IIC(M)A18D	2.96
IIC(M)A20D	1.91
IIC(M)A20I	3.95
IIC(M)A21D	1.80
IIC(M)A23D	2.23
IIC(M)A24D	<0.10
IIC(M)A25D	1.31
IIC(M)A26D	3.57
IIC(M)A28D	1.78
IIC(M)A29D	0.68
IIC(M)A30D	<0.10
IIC(M)A32D	1.16
IIC(M)A33D	2.60
IIC(M)A34D	1.90
IIC(M)A35D	1.63
IIC(M)A36D	3.56
IIC(M)A37D	<0.10
IIC(M)A38D	<0.10
IIC(M)A39D	<0.10
IIC(M)A40D	<0.10
IIC(M)A41D	<0.10
IIC(M)A42D	0.16
IIC(M)A43D	2.67

D - Drinking water
I - Irrigation water
B - Before water purification unit (GAC)
A - After water purification unit (GAC)

* - All concentrations shown in mg/L.

tetrachloroethene, trichloroethene, 1,2–dichloroethene, BTX compounds (benzene, toluene and xylene), and chlorobenzene. Tetrachloroethene, trichloroethene, 1,2–dichloroethene were detected at 50% (19 of 38) of the points sampled, while BTX compounds (including chlorobenzene) were found at approximately 37% (14 of 38) of the sampling locations. 1,1,1–Trichloroethene was detected at only one sampling point and 2–butanone was found at three sampling locations.

It should be noted that the organic compounds such as bis(2–ethylhexyl) phthalate, acetone and methylene chloride were found in sample method blanks; chloroform and methylene chloride were detected in field blanks; and methylene chloride was detected in a trip blank. All of these compounds are common laboratory contaminants, as are carbon disulfide and diethylphthalate. In addition, benzene and toluene were also found in field blanks. These latter two contaminants were probably present in the ambient air at the sample location and introduced into the sample when the blanks were prepared in the field.

As stated above, the most commonly found contaminants and analytes of concern were tetrachloroethene, trichloroethene, 1,2–dichloroethene similar to the results obtained from samples collected from the ground water monitoring wells in the study area. These compounds were found in combination or individually in samples obtained from 76% (19 of 25) of the sampling points at which contamination was detected.

Concentrations of tetrachloroethene were found at 60% (15 of 25) of the sampling points that contained contamination and values ranged from 1 to 58 ug/l. The mean concentration of this compound was 15 ug/l and the median was 10.5 ug/l. The highest levels of tetrachloroethene were found at sampling point A3 (58 ug/l) in a sample taken from a well utilized for irrigation purposes, and at sampling point A14 (45 ug/l) in a sample obtained before a water purification unit (carbon [GAC] unit) attached to the water supply system of the homeowner's drinking water well. Both of these sampling points, A3 and A14 are located at the south end of Vinton and Lake Avenues, respectively as well as sampling location A2 (22 ug/l) which also showed high concentrations of tetrachloroethene. In general, this compound was found in almost all of the samples collected from the homes along Vinton and Lake Avenues located downgradient of and/or along the stormwater drainage system that serves the Hunting Ridge Mall. Other sampling locations with elevated levels of tetrachloroethene were at the Mall itself (A21) (27 ug/l) and at adjacent establishments namely, Perrenial Gardens (A20) (12 ug/l) and the Village Inn Restaurant (A28) (15 ug/l). In addition, it should be noted that trace levels of tetrachloroethene (6 ug/l) were found at sampling point A24, located approximately 3,400 feet northwest and upgradient of the Mall.

Trichloroethene was detected at only four of the sampling points that contained contamination. Concentrations of this compound ranged from 7 ug/l, at A13 and A17, to 3 ug/l at A24 (upgradient of the Mall) and A35.

Concentrations of 1,2–dichloroethene were found at 44% (11 of 25) of the sampling points where contamination was detected. Values ranged from 2 ug/l to 13 ug/l with the mean concentration being 5.5 ug/l and the median being 5 ug/l. The highest levels were found at sampling points A11 (13 ug/l) and A12 (8 ug/l) both located on Lake Avenue. The sample at A11 was obtained before the water purification unit (carbon [GAC] unit) installed on the drinking water supply well system while the A12 household did not have a GAC unit. Many of the samples obtained from the water supply wells of the households, located downgradient of the Mall along Lake and Vinton Avenues, contained concentrations of 1,2–dichloroethene between 3 and 6 ug/l. The Mall (A21) sample also contained this compound (5 ug/l), as well as sample points A26 (2 ug/l), the Village Inn Restaurant (A28) (5 ug/l) and the hardware store (A29) (3 ug/l).

BTX compounds and chlorobenzene, were found in combination with each other or individually at 56% (14 of 25) of the sampling points at which contamination was detected. Benzene was found at three sampling points. The highest concentration of benzene, 3 ug/l, was detected at A2. This level was found in a sample taken after a water purification unit (GAC) that was attached to the drinking water system. The samples taken from the two other locations only had trace amounts of benzene. Chlorobenzene, a compound used as a solvent, was found at four sampling points. The highest level of chlorobenzene was also found to be 3 ug/l but at A20 (Perennial Gardens). Toluene was detected at 32% (8 of 25) of the sampling points with levels ranging from 0.9 to 5 ug/l. The highest concentration (5 ug/l) was found in a sample obtained after the GAC unit at sampling point A2. The mean concentration of toluene was 1.6 ug/l and the median was 1 ug/l. Four sampling locations contained xylene. The maximum concentration detected was 9 ug/l found at sampling point A26, a private residence located adjacent to the Shorco gasoline station. Concentrations of 4 ug/l were detected at A23 and in a sample taken after the GAC unit at A2.

As shown in Table No. 5–1, it should be noted that benzene and toluene were found in a field blank that was prepared at sample location A2 and that toluene was detected in the field blank obtained at sample location A11. Since both field blanks were prepared in the basements of each sample location (private residence) where various products such as paints, thinners and/or gasoline are often stored (as well as vapors/fumes from oil burners), it is possible that the contamination may also be attributed to concentrations of these compounds present in the ambient air of these confined spaces (basements) that were introduced to the sample when the field blanks were obtained.

Only one sampling location, A33, contained levels of 1,1,1-trichloroethane. However, two wells (an irrigation well and a drinking water well) sampled at A33 both contained levels of this compound. The drinking water supply well sample (note that no GAC unit was present) contained 9 ug/l of 1,1,1-trichloroethane and the irrigation well sample contained 5 ug/l.

Three separate samples contained low levels (0.6, 0.7 and 1 ug/l) of 2-butanone which is also known as methyl ethyl ketone. This organic compound maybe a laboratory contaminant, however, it was also found in a number of source/surficial samples obtained in the study area and appears more likely to be an environmental contaminant.

5.2.2 Results of Samples Analyzed for Inorganic Constituents

As noted earlier in Section 5.2, Table No. 5-2 shows the results of the samples analyzed for metals and Table No. 5-3 lists the results of the nitrate-nitrogen analyses. Although a number of inorganic chemicals were detected, primarily metals, none of those exhibiting high concentrations have been identified as contaminants of concern by Federal or New York State regulatory agencies. However, it should be noted that elevated nitrate concentrations were recorded at two sampling locations, namely, A14 (in two separate samples [9.27 and 7.11 mg/l]) and A13 (7.35 mg/l).

5.3 Historical Water Supply Sampling Data

As part of the Water Supply Sampling Program, historical potable water supply data was reviewed. This data included the results of a sampling program undertaken by USEPA in May 1986, results obtained by WCDH in June, July and August of 1983, and March and September of 1987, and recent data in June of 1988.

Table No. 5-4 summarizes the aforementioned data obtained by USEPA, WCDH, and the most recent data collected from the Water Supply Sampling Program which is designated NYSDEC.

Table No. 5-4
BEDFORD WATER SUPPLY SAMPLING PROGRAM
HUNTING RIDGE MALL
HISTORICAL WATER SUPPLY SAMPLING DATA

9 Vinton-IIC(M)A1D

Parameters	6/27/83 (WCHD)	5/28/86 (USEPA)	6/1/88 (WCHD)	10/24/88 (NYSDEC)*
Trichloroethene				
Tetrachloroethene			1.1	
1,2-Dichloroethene			t	
1,2-Dichloroethene (Trans)				
1,2-Dichloroethene (Total)				
1,1-Dichloroethene				
Benzene				
1,1,1-Trichloroethane				
Phenol				
Pyrene				
Toluene				2.0 J
Chlorobenzene				
2-Butanone				
1,4-Dichlorobenzene				
Vinyl Chloride				
Total Xylenes				
Ethyl Benzene				
Chloroethane				

17 Vinton-IIC(M)A2D

Parameters	6/27/83 (WCHD)	8/15/83 (WCHD)	6/1/88 (WCHD)B	6/1/88 (WCHD)A	10/24/88 (NYSDEC)B	10/24/88 (NYSDEC)A
Trichloroethene			t			
Tetrachloroethene	12.0	12.0	83.0		22.0	
1,2-Dichloroethene	2.9	3.3	3.6			
1,2-Dichloroethene (Trans)						
1,2-Dichloroethene (Total)					6.0	
1,1-Dichloroethene						
Benzene						3.0 J
1,1,1-Trichloroethane						
Phenol						
Pyrene						
Toluene						5.0
Chlorobenzene						
2-Butanone						
1,4-Dichlorobenzene						
Vinyl Chloride						
Total Xylenes						4.0 J
Ethyl Benzene						
Chloroethane						

21 Vinton-IIC(M)A3

Parameters	6/27/83 (WCHD)	5/28/86 (USEPA)+	5/28/86 (USEPA)-	3/5/87 (WCHD)	9/9/87 (WCHD)-	9/9/87 (WCHD)+	6/1/88 (WCHD)	10/24/88 (NYSDEC)D*	10/24/88 (NYSDEC)I
Trichloroethene			<5.0		2.3				
Tetrachloroethene			47.0		70.0	2.2	0.7	3.0 J	58.0
1,2-Dichloroethene					7.2				
1,2-Dichloroethene (Trans)									
1,2-Dichloroethene (Total)									5.0
1,1-Dichloroethene									
Benzene									
1,1,1-Trichloroethane									
Phenol									
Pyrene									
Toluene					2.8				
Chlorobenzene									
2-Butanone									
1,4-Dichlorobenzene									
Vinyl Chloride									
Total Xylenes									2.0 J
Ethyl Benzene									
Chloroethane									

20 Vinton-IIC(M)A4D

Parameters	6/27/83 (WCHD)	5/28/86 (USEPA)	9/9/87 (WCHD)	6/1/88 (WCHD)gt	10/25/88 (NYSDEC)*
Trichloroethene					
Tetrachloroethene			1.2	1.5	2.0 J
1,2-Dichloroethene	1.4		5.8	4.0	
1,2-Dichloroethene (Trans)					
1,2-Dichloroethene (Total)					5.0
1,1-Dichloroethene					
Benzene					
1,1,1-Trichloroethane					
Phenol					
Pyrene					
Toluene					
Chlorobenzene					2.0 J
2-Butanone					
1,4-Dichlorobenzene					
Vinyl Chloride					
Total Xylenes					
Ethyl Benzene					
Chloroethane					

12 Vinton-IIC(M)A5D

Parameters	6/30/83 (WCHD)	5/28/86 (USEPA)	6/1/88 (WCHD)	10/24/88 (NYSDEC)
Trichloroethene				
Tetrachloroethene	2.9	<5.0	7.9	11.0
1,2-Dichloroethene	2.2		3.7	
1,2-Dichloroethene (Trans)				
1,2-Dichloroethene (Total)				5.0
1,1-Dichloroethene				
Benzene				
1,1,1-Trichloroethane			0.7	
Phenol				
Pyrene				
Toluene				
Chlorobenzene				
2-Butanone				
1,4-Dichlorobenzene				
Vinyl Chloride				
Total Xylenes				
Ethyl Benzene				
Chloroethane				

8 Vinton-IIC(M)A6D

Parameters	6/27/83 (WCHD)	6/1/88 (WCHD)	10/24/88 (NYSDEC)
Trichloroethene			
Tetrachloroethene	3.4	4.8	4.0 J
1,2-Dichloroethene	1.2	1.1	
1,2-Dichloroethene (Trans)			
1,2-Dichloroethene (Total)			
1,1-Dichloroethene			
Benzene			
1,1,1-Trichloroethane			
Phenol			
Pyrene			
Toluene			
Chlorobenzene			
2-Butanone			
1,4-Dichlorobenzene			
Vinyl Chloride			
Total Xylenes			
Ethyl Benzene			
Chloroethane			

2 Vinton-IIC(M)A7D

Parameters	6/13/83 (WCHD)	5/28/86 (USEPA)B	5/28/86 (USEPA)A	6/1/88 (WCHD)B	6/1/88 (WCHD)A	10/24/88 (NYSDEC)
Trichloroethene						
Tetrachloroethene				0.6	1.0	
1,2-Dichloroethene						
1,2-Dichloroethene (Trans)						
1,2-Dichloroethene (Total)						
1,1-Dichloroethene						
Benzene						
1,1,1-Trichloroethane						
Phenol						
Pyrene						
Toluene						
Chlorobenzene						
2-Butanone						
1,4-Dichlorobenzene						
Vinyl Chloride						
Total Xylenes						
Ethyl Benzene						
Chloroethane						

* - Sample analyzed for full Hazardous Substance List
D - Drinking water
I - Irrigation water
gt - Garden tap
B - Before water purification unit
Bt - Between water purification unit
A - After water purification unit

(+) - Sample taken from 500 ft. well
(-) - Sample taken from 125 ft. well
J - Indicates estimated value
t - trace

Note: All concentrations shown in ug/l.

Table No. 5-4 (continued)
BEDFORD WATER SUPPLY SAMPLING PROGRAM
HUNTING RIDGE MALL
HISTORICAL WATER SUPPLY SAMPLING DATA

381 Old Post-IIC(M)A8D

Parameters	6/30/83 (WCHD)	8/15/83 (WCHD)	5/28/86 (USEPA)B	5/28/86 (USEPA)A	3/5/87 (WCHD)B	3/5/87 (WCHD)A	9/9/87 (WCHD)B	9/9/87 (WCHD)A	6/1/88 (WCHD)B	6/1/88 (WCHD)A	10/25/88 (NYSDEC)B	10/25/88 (NYSDEC)A
Trichloroethene	1.4	1.2										
Tetrachloroethene	27.0	22.0	12.0		25.0		26.0		24.0		17.0	
1,2-Dichloroethene	4.2	4.5					1.9					
1,2-Dichloroethene (Trans)												
1,2-Dichloroethene (Total)												
1,1-Dichloroethene												
Benzene												
1,1,1-Trichloroethane												
Phenol												
Pyrene												
Toluene												
Chlorobenzene												
2-Butanone												
1,4-Dichlorobenzene												
Vinyl Chloride												
Total Xylenes												
Ethyl Benzene												
Chloroethane												

5 Lake-IIC(M)A°D

Parameters	6/13/83 (WCHD)	5/28/86 (USEPA)B	5/28/86 (USEPA)A	3/5/87 (WCHD)B	3/5/87 (WCHD)Bt	3/5/87 (WCHD)A	9/9/87 (WCHD)B	9/9/87 (WCHD)Bt	9/9/87 (WCHD)A	6/1/88 (WCHD)B	6/1/88 (WCHD)Bt	6/1/88 (WCHD)A	10/26/88 (NYSDEC)B	10/26/88 (NYSDEC)A
Trichloroethene	3.4	(5.0		1.7						0.9				
Tetrachloroethene	10.0	7.0		4.5			1.8			2.7			3.0 J	
1,2-Dichloroethene	13.0			2.1			3.9			1.8				
1,2-Dichloroethene (Trans)														
1,2-Dichloroethene (Total)													3.0 J	
1,1-Dichloroethene														
Benzene														
1,1,1-Trichloroethane														
Phenol														
Pyrene														
Toluene				1.2										
Chlorobenzene														
2-Butanone														
1,4-Dichlorobenzene														
Vinyl Chloride														
Total Xylenes														
Ethyl Benzene														
Chloroethane														

* - Sample analyzed for full Hazardous Substance List
D - Drinking water
I - Irrigation water
gt - Garden tap
B - Before water purification unit
Bt - Between water purification unit
A - After water purification unit

(+) - Sample taken from 500 ft. well
(-) - Sample taken from 125 ft. well
J - Indicates estimated value
t - trace

Note: All concentrations shown in ug/l.

Table No. 5-4 (continued)
BEDFORD WATER SUPPLY SAMPLING PROGRAM
HUNTING RIDGE MALL
HISTORICAL WATER SUPPLY SAMPLING DATA

13 Lake-IIC(M)A11D

Parameters	6/6/83 (WCHD)	8/15/83 (WCHD)	8/24/83 (WCHD)	5/28/86 (USEPA)B	5/28/86 (USEPA)A	3/5/87 (WCHD)B	3/5/87 (WCHD)Bt	3/5/87 (WCHD)A	6/1/88 (WCHD)B	6/1/88 (WCHD)Bt	6/1/88 (WCHD)A	10/25/88 (NYSDEC)B	10/25/88 (NYSDEC)A
Trichloroethene		1.1	1.1	<5.0		1.2			0.9				
Tetrachloroethene	6.4	6.3	5.6	<5.0		7.3			6.6			10.0	
1,2-Dichloroethene	30.0	55.0	30.0						4.5				
1,2-Dichloroethene (Trans)													
1,2-Dichloroethene (Total)												13.0	
1,1-Dichloroethene													
Benzene						2.7							0.7 J
1,1,1-Trichloroethane		1.0	1.0										
Phenol													
Pyrene													
Toluene													
Chlorobenzene													
2-Butanone													
1,4-Dichlorobenzene													
Vinyl Chloride													
Total Xylenes													
Ethyl Benzene													
Chloroethane													

17 Lake-IIC(M)A12D

Parameters	6/30/83 (WCHD)	5/28/86 (USEPA)	3/5/87 (WCHD)B	3/5/87 (WCHD)A	9/9/87 (WCHD)B	9/9/87 (WCHD)A	6/1/88 (WCHD)	10/25/88 (NYSDEC)	10/25/88 (NYSDEC)MS	10/25/88 (NYSDEC)MSD
Trichloroethene										
Tetrachloroethene					1.4	t	1.1	1.0 J	1.0 J	2.0 J
1,2-Dichloroethene	3.5				9.6	8.4	9.2			
1,2-Dichloroethene (Trans)										
1,2-Dichloroethene (Total)								8.0	8.0	8.0
1,1-Dichloroethene										
Benzene			6.6	9.7						
1,1,1-Trichloroethane										
Phenol										
Pyrene										
Toluene										
Chlorobenzene										
2-Butanone									3.0 J	0.9 J
1,4-Dichlorobenzene										
Vinyl Chloride										
Total Xylenes										
Ethyl Benzene										
Chloroethane										

* - Sample analyzed for full Hazardous Substance List
D - Drinking water
I - Irrigation water
gt - Garden tap
B - Before water purification unit
Bt - Between water purification unit
A - After water purification unit

(+) - Sample taken from 500 ft. well
(-) - Sample taken from 125 ft. well
J - Indicates estimated value
t - trace
MS - Matrix spike
MSD - Matrix spike duplicate

Note: All concentrations shown in ug/l.

Table No. 5-4 (continued)
BEDFORD WATER SUPPLY SAMPLING PROGRAM
HUNTING RIDGE MALL
HISTORICAL WATER SUPPLY SAMPLING DATA

	21 Lake-IIC(M)A13D					25 Lake-IIC(M)A14D											
Parameters	6/30/83 (WCHD)	5/28/86 (USEPA)	3/5/87 (WCHD)	6/1/88 (WCHD)	10/25/88 (NYSDEC)	7/6/83 (WCHD)	8/24/83 (WCHD)	5/28/86 (USEPA)B	5/28/86 (USEPA)A	3/5/87 (WCHD)B	3/5/87 (WCHD)Bt	3/5/87 (WCHD)A	6/1/88 (WCHD)B	6/1/88 (WCHD)Bt	6/1/88 (WCHD)A	10/24/88 (NYSDEC)B	10/24/88 (NYSDEC)A
Trichloroethene					1.0 J					1.0			0.9				
Tetrachloroethene						5.2	5.8	27.0		53.0			66.0			45.0	
1,2-Dichloroethene						10.0	3.5						2.6				
1,2-Dichloroethene (Trans)																	
1,2-Dichloroethene (Total)																	
1,1-Dichloroethene																	
Benzene										5.7							
1,1,1-Trichloroethane																	
Phenol																	
Pyrene																	
Toluene					1.0 J												
Chlorobenzene					0.8 J												
2-Butanone					0.7 J												
1,4-Dichlorobenzene																	
Vinyl Chloride																	
Total Xylenes																	
Ethyl Benzene																	
Chloroethane																	

	12 Lake-IIC(M)A15D					9 Lake-(No sample no.; access denied)										
Parameters	6/23/83 (WCHD)	5/28/86 (USEPA)	6/1/88 (WCHD)B	6/1/88 (WCHD)A	10/25/88 (NYSDEC)	6/23/83 (WCHD)	8/15/83 (WCHD)	8/24/83 (WCHD)	5/28/86 (USEPA)B	5/28/86 (USEPA)A	3/5/87 (WCHD)B	3/5/87 (WCHD)A	9/9/87 (WCHD)B	9/9/87 (WCHD)A	6/1/88 (WCHD)B	6/1/88 (WCHD)A
Trichloroethene						7.6	8.4	6.1	<5.0		2.1		1.1		0.7	
Tetrachloroethene						20.0	18.0	15.0	<5.0		7.1		5.4		3.1	
1,2-Dichloroethene	4.0					14.0	24.0	12.0					1.9		t	
1,2-Dichloroethene (Trans)																
1,2-Dichloroethene (Total)																
1,1-Dichloroethene																
Benzene																
1,1,1-Trichloroethane			0.7	0.8												
Phenol																
Pyrene																
Toluene																
Chlorobenzene					0.5 J											
2-Butanone																
1,4-Dichlorobenzene																
Vinyl Chloride																
Total Xylenes																
Ethyl Benzene																
Chloroethane																

* - Sample analyzed for full Hazardous Substance List
D - Drinking water
I - Irrigation water
gt - Garden tap
B - Before water purification unit
Bt - Between water purification unit
A - After water purification unit

(+) - Sample taken from 500 ft. well
(-) - Sample taken from 125 ft. well
J - Indicates estimated value
t - trace

Note: All concentrations shown in ug/l.

The data shows that, in general, tetrachloroethene concentrations have not increased between 1983 and 1988. However, two sampling points (A5 and A11 along Lake Avenue) experienced minor increases in tetrachloroethene concentrations. Concentrations of 1,2–dichloroethene are shown to be decreasing or remaining nearly the same since 1983 except for slight increases experienced at sample location A12 (also along Lake Avenue). Sampling points at which trichloroethene was detected showed decreasing concentrations or no change. In addition, the low levels of 1,1,1–trichloroethane detected at some locations have decreased.

The BTX (benzene, toluene and xylene) compounds, including chlorobenzene, appear to show a trend of slightly increasing concentrations. Although the concentrations detected were minimal and only found at a limited number of locations, the values did increase over time at sampling points A1, A3, A4 and A13. Also, concentrations of BTX compounds oddly increased in a sample obtained after a GAC unit at sample location A2. However, as discussed in Section 5.2.1, benzene and toluene were found in a field blank collected at A2 and contamination by these compounds could have been introduced via concentrations found in ambient air as indicated by the field blank contamination. Conversely, concentrations of BTX compounds decreased at sampling points A11 and A14.

It should be noted that data showing concentrations of contaminants in samples collected prior to GAC units, and where no units were present, constitute data that can be used to evaluate ground water contamination. Data from samples obtained after a GAC unit and when no GAC unit existed, but the water is still used as a potable water supply, constitutes data that can be utilized to evaluate risks to public health. This information will be discussed in the Discussion and Health Risk Assessment Sections (6.0 and 7.0, respectively) of this report.

5.4 Applicable Water Quality Standards and Significance of Sampling Results

5.4.1 Organic Compounds

The New York State Department of Health (NYSDOH) drinking water standards and NYSDEC ambient ground water standards and guidelines for organic compounds are listed in Table No. 5–5. By comparing Tables Nos. 5–5 and Table 5–1 (sample results for organic compounds) it is found that the State standards and guidelines were exceeded. Table No. 5–6 is a summary in matrix form showing the sampling locations and concentrations exceeding the standards and guidelines. It also shows those locations that had samples with concentrations at or above the guidance values or standards.

Table No. 5-5

NEW YORK STATE
DRINKING WATER AND GROUND WATER STANDARDS
AND GUIDELINES
FOR SELECT ORGANIC COMPOUNDS*

Parameters	NYSDOH Drinking Water Standards (Part 5)	NYSDEC Ground Water Standards (Part 703/TOGS)
Tetrachloroethene	5 (POC)	0.7 (GV)
Trichloroethene	5 (POC)	10
1,1-Dichloroethene	5 (POC)	0.07 (GV)
1,2-Dichloroethene	5 (POC)	NA
1,1,1-Trichloroethane	5 (POC)	50 (GV)
1,1,2-Trichloroethane	5 (POC)	0.6 (GV)
1,1-Dichloroethane	5 (POC)	50 (GV)
1,2-Dichloroethane	5 (POC)	0.8 (GV)
Chloroethane	5 (POC)	NA
Methyl ethyl ketone (2-Butanone)	50 (UOC)	NA
Benzene	5 (POC)	ND
Chlorobenzene	5 (POC)	20 (GV)
Ethylbenzene	5 (POC)	50 (GV)
Toluene	5 (POC)	50 (GV)
Xylene(Total)	5 (POC)	50 (GV)

* All concentrations for standards and guidelines are shown in ug/l.

GV – Guidance value
ND – Non-detectable
NA – None available (no standard or guideline available)
UOC – Unspecified Organic Contaminant (NYSDOH Standard for UOC's = 50 ug/l).
POC – Principle Organic Contaminant (NYSDOH Standard for POC's = 5 ug/l).

Table No. 5–6

SUMMARY MATRIX OF SAMPLING LOCATIONS WITH CONCENTRATIONS EXCEEDING NEW YORK STATE DEPARTMENT OF HEALTH DRINKING WATER STANDARDS FOR ORGANIC COMPOUNDS*

Parameter Exceeded (Concentration detected in ug/l)

Sample Location	Tetrachloroethene	1,2–Dichloroethene	1,1,1–Trichloroethane	Toluene	Xylene
A2 (D) 17 Vinton Avenue	22 (B)	6 (B)		Std. (A)	
A3 (I) 21 Vinton Avenue	58	Std.			
A4 (D) 20 Vinton Avenue		Std.			
A5 (D) 12 Vinton Avenue	11	Std.			
A8 (D) 381 Old Post Road	17 (B)				
A11 (D) 13 Lake Avenue	10 (B)	13 (B)			
A12 (D) 17 Lake Avenue		8			
A14 (D) 25 Lake Avenue	45 (B)				
A20 (D) 414 Old Post Road	12				
A21 (D) 420–442 Old Post Road (Hunting Ridge Mall)	27	Std.			
A24 (D) Sunnyfield Farm	6				
A26 (D) 452 Old Post Road					9
A28 (D) 454 Old Post Road (Village Inn)	15	Std.			

Table No. 5-6 (continued)

SUMMARY MATRIX OF SAMPLING LOCATIONS WITH CONCENTRATIONS EXCEEDING NEW YORK STATE DEPARTMENT OF HEALTH DRINKING WATER STANDARDS FOR ORGANIC COMPOUNDS*

Parameter Exceeded (Concentration detected in ug/l)

Sample Location	Tetrachloroethene	1,2-Dichloroethene	1,1,1-Trichloroethane	Toluene	Xylene
A33 (D) 480 Old Post Road			9		
A33 (I) 480 Old Post Road			Std.		

* Drinking water standard for all parameters shown is 5 ug/l.

(D) – Drinking water supply well sample
(I) – Irrigation well sample
Std. – Concentration detected was detected at same level as standard (5 ug/l).
(A) – Location that contained a GAC unit and sample obtained after GAC unit.
(B) – Location that contained a GAC unit and sample obtained before GAC unit.

From inspecting Table Nos. 5-1, 5-5 and 5-6, it is found that 10 of the 38 sampling locations (26%) had sample concentrations that exceeded the drinking water standard of 5 ug/l for tetrachloroethene. These locations were A2, A3, A5, A8, A11, A14, A20, A21, A24 and A28. Sampling locations A3 (58 ug/l), A14 (45 ug/l), A21 (27 ug/l) and A2 (22 ug/l) contained the highest levels of this compound. Three (3) sampling locations (A2, A11 and A12) had samples with concentrations that exceeded the standard for 1,2-dichloroethene. Also five sampling locations (A3, A4, A5, A21 and A28) had sample concentrations that were at the drinking water standard of 5 ug/l for 1,2-dichloroethene. Only one sample (from A33D) contained a concentration that was in contravention of the standard for 1,1,1-trichloroethane of 5 ug/l, and one sample (A33I) had levels that were at this standard. The standard for xylene (5 ug/l) was exceeded at sample location A24 and the concentration of toluene at location A2 (in a sample taken after a GAC unit) was found to be at the level of the standard (5 ug/l). All of the aforementioned samples that contained contamination were obtained at locations that did not have GAC units or were taken before the GAC unit (except for A2 where the sample was obtained after the GAC unit). It should be noted that none of the samples obtained after GAC units contained concentrations of contaminants that exceeded the NYSDOH drinking water standard for the organic compounds discussed.

The NYSDEC standards and guidelines for ground water are also shown in Table No. 5-5. By comparing Table Nos. 5-5 and 5-1 it is found that the NYSDEC ambient ground water standards and/or guidance values for tetrachloroethene and benzene were exceeded. The guidance value (0.7 ppb) for tetrachloroethene was exceeded at 15 of the 38 sampling locations (39%), and the standard (ND, [non-detectable]) for benzene was exceeded at three sampling locations. All of these samples were obtained at locations that did not have GAC units or were taken before the GAC unit except for the benzene concentrations detected at sampling points A2 and A11, which were found in samples that were obtained after GAC units. However, as addressed earlier in Section 5.2.1, benzene was also found in the field blanks that were prepared at both locations A2 and A11 and therefore, this contamination could have been introduced to the sample from ambient air concentrations as detected in the field blanks. All other samples that were taken after the GAC units did not contain concentrations of contaminants in excess of the ground water standards and guidelines. All of the aforementioned information is summarized in matrix form in Table No. 5-7.

Table No. 5–7

SAMPLING LOCATIONS WITH CONCENTRATIONS EXCEEDING NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION GROUND WATER STANDARDS/GUIDELINES FOR ORGANIC COMPOUNDS

Parameter Exceeded (Concentration detected in ug/l)

Sample Location	Tetrachloroethene*	Benzene**
A2 (D) 17 Vinton Avenue	22 (B)	3 (A)
A3 (D) 21 Vinton Avenue	3	
A3 (I) 21 Vinton Avenue	58	
A4 (D) 20 Vinton Avenue	2	
A5 (D) 12 Vinton Avenue	11	
A6 (D) 8 Vinton Avenue	4	
A8 (D) 381 Old Post Road	17 (B)	
A9 (D) 5 Lake Avenue	3	
A11 (D) 13 Lake Avenue	10 (B)	0.7 (A)
A12 (D) 17 Lake Avenue	1	
A14 (D) 25 Lake Avenue	45 (B)	
A20 (D) 414 Old Post Road	12	
A21 (D) 420–442 Old Post Road (Hunting Ridge Mall)	27	
A24 (D) Sunnyfield Farm	6	

Table No. 5–7 (continued)

SAMPLING LOCATIONS WITH CONCENTRATIONS
EXCEEDING NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GROUND WATER STANDARDS/GUIDELINES FOR ORGANIC COMPOUNDS

Parameter Exceeded (Concentration detected in ug/l)

Sample Location	Tetrachloroethene*	Benzene**
A28 (D) 454 Old Post Road (Village Inn)	15	
A35 (D) 399 Old Post Road (1 The Farms Road)	4	0.4

* Guidance value for tetrachloroethene (PCE) = 0.7 ug/l.

** Standard for benzene = ND (Non–detectable)

(D) – Drinking water supply well sample

(I) – Irrigation well sample

(A) – Location that contained a GAC unit and sample obtained after GAC unit

(B) – Location that contained a GAC unit and sample obtained before GAC unit

5.4.2 Inorganic Constituents

The New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) standards and guidelines for inorganic constituents in ground water and drinking water are shown in Table No. 5–8. Comparing this table to the sample results for inorganic constituents in Table No. 5–2 (metals) and 5–3 (nitrates) it is found that although a number of inorganic chemicals were detected, primarily metals, however, none exhibited concentrations that exceeded the existing standards and guidelines for ground water and drinking water. It should be noted that high nitrate concentrations were recorded at two sampling locations, namely, A14 and A13. Two separate samples (one before and one after a GAC unit) collected at A14 showed 9.27 and 7.11 mg/l of nitrates. The sample obtained at location A13 contained 7.35 mg/l nitrates. Also, although there are no drinking water and ground water standards or guidelines for aluminum, calcium, magnesium, potassium and sodium, it appears that elevated concentrations were detected in several samples. However, these chemicals are often found naturally in ground water at high levels.

Table No. 5-8

NEW YORK STATE DRINKING WATER AND GROUND WATER STANDARDS AND GUIDELINES FOR INORGANIC CONSTITUENTS*

Parameters	NYSDEC Ground Water Standards (Part 703.5)	NYSDEC Ground Water Standards and Guidelines (TOGS)	NYSDOH Drinking Water Standards
Aluminum	—	—	—
Antimony	—	3 (GV)	3 (GV)
Arsenic	25	25	50
Barium	1,000	1,000	1,000
Beryllium	—	3 (GV)	—
Cadmium	10	10	10
Calcium	—	—	—
Chromium	50 (Hex)	—	50 (Hex)
Cobalt	—	—	—
Copper	1,000	1,000	—
Iron	300**	300	300
Lead	25	25	50
Magnesium	—	35,000 (GV)	—
Manganese	300**	300	300
Mercury	2	2	2
Nickel	—	—	7.1 (GV)
Potassium	—	—	—
Selenium	20	20	10
Silver	50	50	50
Sodium	—	—	—
Thallium	—	4 (GV)	—
Vanadium	—	—	—
Zinc	5,000	5,000	—
Nitrate	10,000	10,000	10,000
Cyanide	200	200	100

* All concentrations shown in ug/l.
** Combined concentration of Iron and Manganese shall not exceed 500 ug/l.

GV – Guidance Value (no NYS standard)

Section 6

6.0 DISCUSSION OF SITE CONTAMINATION

The purpose of this section is to provide a discussion of the significance and possible cause of contamination found during this Remedial Investigation. The determination of significance, at least on a preliminary basis (with final determination based on the detailed health risk assessment provided in the following section) will be in relation to Applicable or Relevant and Appropriate Requirements (ARARs). Areas and matrices determined to be "significantly" contaminated will be the focus of the risk assessment. For this Remedial Investigation/Feasibility Study (RI/FS), the ARARs selected in coordination with the New York State Department of Environmental Conservation (NYSDEC) are the ambient ground water and surface water quality, and effluent limitation standards and guidance values established in the April 1987 Division of Water Quality Technical Operational Guidance Series (TOGS) Memorandum, the Maximum Contaminant Levels (MCLs) for drinking water supplies adopted by the New York State Department of Health (NYSDOH), and the New Jersey Department of Environmental Protection (NJDEP) Soil Cleanup Guidelines. (It should be noted that USEPA MCLs were reviewed, but because NYSDOH MCLs are as stringent, or more stringent in some cases, the New York State MCLs were utilized as the ARARs for drinking water.)

The focus of discussion below will be with regard to the analytes of concern established for this project, these being the dry cleaning solvent tetrachloroethene, and its breakdown compounds, trichloroethene, cis/trans-1,2-dichloroethene and vinyl chloride (chloroethene), 1,1,1-trichloroethane and the BTX compounds (benzene, toulene and xylene). The selection of these compounds as the analytes of concern was based on their early discovery in suspected sources, environment samples and drinking water supply in the study area. Following this section and the section on risk assessment (Section 7.0), recommendations are provided for mitigation and evaluation in the Feasibility Study.

6.1 Determination of Applicable or Relevant and Appropriate Requirements (ARARs)

The National Contingency Plan (NCP) requires the determination of the extent to which Federal, state or local public health and environmental standards are applicable or relevant and appropriate to each National Priorities List (NPL) site. In addition, Federal or state advisories, criteria and guidance must be reviewed to determine if they are applicable, relevant or appropriate in developing remedial actions at the site. This section provides a preliminary presentation of these requirements. Although the Hunting Ridge Mall Site is a New York State Superfund site and not a NPL site, because this RI/FS is being conducted in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the determination of Applicable or Relevant and Appropriate Requirements is germaine to this study. As mentioned above, the establishment of ARARs and comparison to the results of this investigation will determine areas of significant contamination on a preliminary basis and provide a point of reference for performance of the health risk assessment in the following section and the subsequent Feasibility Study, and ultimately, the selection of an appropriate remedial action, if warranted.

A large number of potential Federal and state ARARs are available for consideration for site evaluation. For this Remedial Investigation, a review was undertaken of Volume I and II of the New York State ARARs, as well as those listed by the United States Environmental Protection Agency (USEPA). Based upon this review, the following standards/guidelines were selected as being the most appropriate for consideration and use at the Hunting Ridge Mall Site. The discussion below provides a summary of the ARARs selected for the contaminants of concern detected in various medias (wastewater effluent and sludge, surface water, ground water, water supply, soil and sediment) in the study area. Since contamination of ambient air by the analytes of concern (volatile organic compounds) has never been detected above background at the site during the site investigation (as measured with a total organic vapor analyzer), ARARs for air are not addressed in this study.

Federal ARARs

- Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) (40 CFR Part 141.11-141.16) - Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) are set at levels which would minimize adverse health effects for water used for drinking water supply. MCLs are enforceable standards, whereas MCLGs are non-enforceable health goals and proposed recommendations. Only MCLs are considered relevant and appropriate for developing cleanup standards while MCLGs are "to be considered." For this investigation, only MCLs are considered applicable as ARARs.

- Resource Conservation and Recovery Act (RCRA) Ground Water Protection Standards (40 CFR 264.90–264.109) – The RCRA Ground Water Protection Standards are appropriate as ARARs because many of the known contaminants are the 40 CFR 261 Appendix VIII list of substances and are present in the ground water above background/ambient levels. The hazardous waste requirements of RCRA applicable to the treatment, storage and disposal of hazardous waste are also potentially applicable to the Hunting Ridge Mall Site.

- Clean Water Act (CWA) Ambient Water Quality Criteria for Protection of Freshwater Aquatic Life (EPA-440/9-76-023) – The CWA Water Quality Criteria for Protection of Aquatic Life are appropriate since fresh water bodies in the study area and the Mianus River support fish and other aquatic organisms and should be protected.

State ARARs

- New York State Department of Environmental Conservation Division of Water Technical and Operational Guidance TOGS (1.1.1) Ambient Water Quality Standards and Guidance Values – The water quality standards and guidance values contained in this document are a compilation of values for toxic and non-toxic pollutants contained in the following:

  - New York State Water Classification and Quality Standards, Chapter X, Part 701–Ambient Water Quality Standards, Appendix 31

  - New York State Water Classification and Quality Standards, Chapter X, Part 703–Ground Water Classifications, Quality Standards, and/or Limitations

  - New York State Water Classification and Quality Standards, Chapter X, Section 703.6–Discharge Criteria for Class GA Waters

  These values are used by NYSDEC in the establishment of discharge permit water quality-based effluent limits and in the evaluation of ambient water quality data. The New York State standards are applicable because it is required that ground water be protected as a potable source and surface water protected as an environmental resource, and that contaminated ground water and surface water be cleaned up to State standards.

- o <u>New York State Department of Health Requirements for General Organic Chemicals in Drinking Water (Public Health Law, Section 201 and 205)</u> - These standards are applicable, because they are established to protect the health of those who are utilizing a ground water or surface water resource as a potable supply. Since all ground water in New York State is classified for drinking water purposes (GA), and since the Mianus River and tributaries in the study area are classified as "AA-Special" because the river is a source of water supply to a downstream community, these requirements are considered as ARARs.

- o <u>New Jersey Department of Environmental Protection Summary of Approaches to Soil Cleanup Levels</u> - Although these cleanup levels were developed for use in New Jersey, since presently, guidance values for soil remedial action have not been established for use in New York, these levels may be applicable for the preliminary assessment of the significance of soil and sediment contamination, as well as cleanup, at the Hunting Ridge Mall Site.

Additional ARARs on the Federal, New York State and local level may be identified based on the results of the selected remedial alternatives (e.g., minimum technology requirements) developed in the Feasibility Study. New York State regulations on treatment, closure/post-closure, landfill requirements, cap performance standards, etc., will be identified, as well as State requirements on air quality, water discharge requirements and injection/recharge regulations.

Table Nos. 6-1, 6-2, 6-3, and 6-4, list the analytes of concern and other contaminants identified in the study area, and the contaminant-specific ARARs for effluent discharge, ground water, surface water and soil, respectively.

As discussed above, for the purposes of this investigation, the ARARs for ambient water will be the New York State surface water and ground water standards and guidelines contained in the TOGS. Where standards or guidelines do not exist in the TOGS, USEPA MCLs or NYSDOH maximum contaminant levels for organic compounds will be used. The NYSDOH MCLs will also be used for ground water, particularly where it applies to drinking water supply.

Table No. 6–1

ARARS FOR EFFLUENT DISCHARGE

Organic Compounds	NYSDEC Part 703.6 (ug/l)
Tetrachloroethene	—
Trichloroethene	—
Cis–1,2–dichloroethene	—
Trans–1,2–dichloroethene	—
1,1,1–Trichloroethane	35
Benzene	ND
Toluene	—
Xylene	—
2–Butanone	—
1,4–Dichlorobenzene	—
Chlorobenzene	—
Ethylbenzene	—
Phenol	—
Metals	
Aluminum	2,000
Antimony	—
Arsenic	50
Barium	2,000
Cadmium	20
Calcium	—
Chromium	100 (Hexavalent)
Copper	1,000
Cyanide	400
Iron	600
Lead	50
Magnesium	—
Manganese	600
Mercury	4
Nickel	2,000
Potassium	—
Silver	100
Sodium	—
Zinc	5,000

Table No. 6-2

ARARS FOR GROUND WATER AND WATER SUPPLY

Organic Compounds	NYSDEC TOGS* (ug/l)	NYSDOH MCL (ug/l)	RCRA MCL (ug/l)	SDWA MCL (ug/l)	SDWA MCLG (ug/l)
Tetrachloroethene	0.7 (G)	5.0	—	—	0
Trichloroethene	10 (G)	5.0	—	5.0	0
Cis-1,2-dichloroethene	—	5.0	—	—	—
Trans-1,2-dichloroethene	50 (G)	5.0	—	—	—
1,1,1-Trichloroethane	50 (G)	5.0	—	—	—
Benzene	ND (S)	5.0	—	5.0	—
Toluene	50 (G)	5.0	—	—	2.0
Xylene	50 (G)	5.0	—	—	—
2-Butanone	—	5.0	—	—	—
1,4-Dichlorobenzene	4.7 (S)	5.0	—	780	780
Chlorobenzene	20 (G)	5.0	—	—	—
Ethylbenzene	50 (G)	5.0	—	—	680
Phenol	1.0 (S)	—	—	—	—
Metals					
Aluminum	—	—	—	—	—
Antimony	3.0 (G)	—	—	—	—
Arsenic	25 (S)	5.0	50	50	—
Barium	1,000 (S)	1,000	1,000	1,000	1,500
Cadmium	10 (S)	10	10	10	5.0
Calcium	—	—	—	—	—
Chromium	50 (Hex)(S)	500	50 (Hex)	50 (Hex)	1.2 (Hex)
Copper	1,000 (S)	1,000	—	—	1,300
Cyanide	200 (S)	200	—	—	—
Iron	300 (S)	300	—	—	—
Lead	25 (S)	50	50	50	20
Magnesium	35,000 (G)	—	—	—	—
Manganese	300 (S)	300	—	—	—
Mercury	2.0 (S)	2.0	2.0	2.0	3.0
Nickel	—	—	13.4	—	—
Potassium	—	—	—	—	—
Silver	50 (S)	50	50	50	—
Sodium	—	—	—	—	—
Zinc	5,000 (S)	5,000	—	—	—

* Class GA Water

(S) Standard
(G) Guidance Value
ND Non-Detectable

Table No. 6–3

ARARS FOR SURFACE WATER

Organic Compounds	NYSDEC TOGS* (ug/l)	CWA Criteria** (ug/l)
Tetrachloroethene	0.7 (G)	5,200/840
Trichloroethene	3.0 (G)	—/—
Cis–1,2–dichloroethene	—	11,000/—
Trans–1,2–dichloroethene	50 (G)	11,000/—
1,1,1–Trichloroethane	50 (G)	
Benzene	1.0 (G)	5,300/—
Toluene	50 (G)	17,000/—
Xylene	50 (G)	—/—
2–Butanone	—	—/—
1,4–Dichlorobenzene	30 (S)	—/—
Chlorobenzene	20 (S)	200/50
Ethylbenzene	50 (G)	32,000/—
Phenol	1.0 (S)	10,000/2,500
Metals		
Aluminum	—	—/—
Antimony	3.0 (G)	9,000/1,600
Arsenic	50 (S)	—/—
Barium	1,000 (S)	—/—
Cadmium	10 (S)	3.9/1.1
Calcium	—	—/—
Chromium	50 (S)	16/11
Copper	200 (S)	18/12
Cyanide	100 (S)	22/5.2
Iron	300 (S)	—/—
Lead	50 (S)	8.2/3.2
Magnesium	35,000 (S)	—/—
Manganese	300 (S)	—/—
Mercury	2.0 (S)	2.4/0.012
Nickel	—	1,800/96
Potassium	—	—/—
Silver	50 (S)	4.1/0.12
Sodium	—	—/—
Zinc	300 (S)	320/47

* Class AA–Special
** Freshwater Acute/Chronic

(S) Standard
(G) Guidance Value
ND Non–Detectable

Table No. 6-4

ARARS FOR SOIL AND SEDIMENT

Organic Compounds	NJDEP Cleanup Level (mg/kg)
Total Volatile Organics	1
Total Base Neutrals	10
Total Acid Extractables	10
Total PCBs	1-5
Total Petroleum Hydrocarbons	100
Metals	
Arsenic	20
Cadmium	3
Chromium	100
Copper	170
Lead	100
Mercury	1
Nickel	100
Selenium	4
Silver	5
Zinc	350
Cyanide	12

6.2 Source/Sanitary System Contamination

6.2.1 Summary of the General Occurrence of Hazardous Substances in Sanitary System Effluent

The primary focus of this Remedial Investigation is to investigate the source and extent of tetrachloroethene contamination and its breakdown compounds (defined as the primary analytes of concern in this study) in the Hunting Ridge Mall Study Area. Based on the nature and location of the chemicals found at the Site, the most likely source of the tetrachloroethene release is a dry cleaner which is located in one of the stores that make up the Mall. It is believed that wastewater containing dry cleaning solvent (tetrachloroethene) entered the Mall's sanitary system and stormwater drainage system. (It is also possible that spills from product and waste material stored in drums behind the dry cleaning establishment may also have entered the drainage system.)

In 1983, sampling conducted by the Westchester County Department of Health (WCDH) identified the subsurface sanitary disposal system (the septic tank and the dosing chamber) serving the Hunting Ridge Mall as containing high concentrations of trichloroethene and cis-1,2-dichloroethene, which are breakdown products of tetrachloroethene. As a result, the Mall owner was required to remove the contaminated material in the sanitary system.

Provision was made in the Phase IA sampling program of this investigation to obtain a sample of the Mall's sanitary system liquid (supernatant) as well as the sludge. The purpose of this analytical data was to determine if there were continuing discharges to the sanitary system and if the system continues to act as a source of residual contamination within the study area.

In the fall of 1987, the owner of the Hunting Ridge Mall installed a new sanitary leaching field for the building. During the construction of the leaching field, the sanitary effluent generated by the Mall was pumped from the holding tanks on a periodic basis and transported off site. When it was attempted to obtain samples from the septic tank, there was no sludge present. As a result, only a supernatant/effluent sample was collected.

Upon analysis of this sample, an estimated value of the dry cleaning compound tetrachloroethene was detected at the concentration of 5.2 ug/l and two of its breakdown products, trichloroethene and 1,2-dichloroethene, were also detected at estimated values of 2.7 ug/l and 2.6 ug/l, respectively. In addition to these compounds, an estimated concentration of 1,1,1-trichloroethane, a common cleaning solvent also used as a septic system cleaner, was detected in this sample at a concentration of 2.2 ug/l. Benzene and toluene, which are other common solvents used for cleaning and for paints and lacquers, as well as gasoline additives, were detected at concentrations of 2.1 ug/l and 340 ug/l, respectively. Phenol was also detected at a concentration of 44 ug/l and silver was found at a level of 39 ug/l.

As discussed above, the TOGS established by NYSDEC are used to define values for effluent limitations as well as ambient water quality standards and guidelines. Assuming discharge to ground water which is classified as GA, the effluent guidance value established for tetrachloroethene is 0.7 ug/l. The estimated concentration of 5.2 ug/l (ug/l) found in the septic tank exceeded this guidance value.

The ambient ground water standard (and assumed guidance value for effluent limits) for the breakdown compound, trichloroethene is 10 ug/l. The estimated concentration of 2.7 ug/l found in the septic system supernatant is below the established standard.

The detection of 1,1,1-trichloroethane, toluene and benzene most likely indicates solvent use in the Mall building and disposal to the sanitary system. The ambient ground water/effluent limitation guidance value for 1,1,1-trichloroethane is 50 ug/l. The estimated 2.2 ug/l concentration detected in the sanitary effluent is below the established limit. The ambient ground water/effluent limitation guidance value for toluene is 50 ug/l. The 340 ug/l toluene concentration detected in the supernatant from the septic tank exceeds the established limits. The ambient ground water/effluent limitation standard for benzene is established as non-detectable. The estimated concentration of 2.7 ug/l benzene in the sanitary effluent exceeds the standard. The level of phenol is above the TOGS standard for total phenol of 1.0 ug/l. The concentration of silver is below the TOGS standard for silver of 50.0 ug/l.

Based on the analytical results, it appears that low concentrations of the dry cleaning solvent and a breakdown product still persist in the Mall's sanitary system. Consistent with the Westchester County Health Department's assessment in 1983, that the new dry cleaning system installed at the establishment "appears to nearly eliminate the generation of wastes," it appears that small amounts of tetrachloroethene may still being discharged to the Mall's sanitary system or that residuals remain in the septic tank from previous disposal practices. However, another likely source is the Mall's water supply itself which is contaminated with tetrachloroethene (27 ug/l) and cis-1,2-dichloroethene (5.0 ug/l).

The solvents 1,1,1–trichloroethane, toluene and benzene appear to be used in the Mall building and discharged to the wastewater disposal system. The contributing source/cause of these contaminants needs to be identified and use/disposal to the sanitary system discontinued, in particular those which exceed the ARARs for effluent discharges (tetrachloroethane, toluene, benzene and phenol).

In addition to the Mall's wastewater disposal system, a review of the Phase IA sampling data indicated the presence of 2–butanone (methyl ethyl ketone) contamination in surface water and sediment in the drainage system/stream along Lake Avenue. The septic tank supernatant sample from the Mall contained 2–butanone at a level of 21.0 ug/l, and the sediment sample from the drainage system catch basin located behind the Mall contained a concentration of 16.0 ug/kg. However, 2–butanone was not detected between this location and the catch basin located at the head of the drainage system/stream along Lake Avenue. A hardware store is located just upgradient of the stream. Due to the nature of this business, its location in the study area and the products sold (such as paints, degreasers and solvents), the hardware store sanitary system was sampled as part of the Phase IB sampling program. This assisted in determining if the hardware store wastewater disposal system was a contributing source of contamination to the study area.

The analysis of the supernatant/effluent sample obtained from this location revealed that it did not contain any of the analytes of concern, although the pesticide heptachlor was found at a level of 0.16 ug/l. The sanitary system sludge, however, contained an estimated concentration of 1,060 ug/kg of 1,4–dichlorobenzene which is used predominantly as an insecticidal fumigant and is popular for domestic use against clothes moths (in the form of mothballs or crystals).

1,4–Dichlorobenzene is essentially insoluable in water which is supported by the non–detectable value of the effluent sample obtained. However, a 4.7 ppb standard has been established for total (sum of para [1,4–] and ortho [1,2–] isomers) dichlorobenzene for an effluent limitation as well as ambient ground water. Although this compound was not detected in the liquid fraction, the sludge may be a potential environmental contaminant, as possibly indicated in water samples obtained in the stream/pond system downgradient of the hardware store along Lake Avenue which indicated some contamination by chlorobenzene. As a result, the source/cause of 1,4–dichlorobenzene should be eliminated from the discharge to the hardware store wastewater disposal system.

In addition, the hardware store septic tank sludge contained elevated levels of copper (480 mg/kg), lead (130 mg/kg) and zinc (2,300 mg/kg) that exceeded the NJDEP guidelines for each of these metals in soil in evaluating cleanup requirements. The NJDEP guidelines for copper, lead and zinc are 170 mg/kg, 100 mg/kg and 350 mg/kg, respectively. Although none of these metals were found in ground water and surface water in the study area at concentrations that exceeded ARARs, the exceedence of the NJDEP soil guidelines suggests the need for further evaluation/investigation of this contamination.

6.3 Surface Water Contamination

6.3.1 Summary of the General Occurrence of Hazardous Substances in Surface Water

Stormwater runoff from the Hunting Ridge Mall, hardware store and adjacent Route 22 is diverted through a subsurface drainage system which discharges to an ephemeral stream which runs parallel to and east of Lake Avenue. The storm drainage that flows along the stream bed travels through a series of three ponds before it discharges to the Mianus River. The first permanent surface water body that receives the stormwater surface runoff from and in the vicinity of the Mall is Turtle Pond which is located just southeast of Lake Avenue.

The Westchester County Department of Health study performed in 1983, collected water samples from six locations in the stormwater drainage system. Analyses of the samples collected indicated the presence of varying concentrations of one or more of volatile organic chemicals, including tetrachloroethene, trichloroethene, cis–1,2–dichloroethene and 1,1,1–trichloroethane. Surface water samples were also collected from the stream along Lake Avenue. The analyses of these samples indicated the presence of low levels of tetrachloroethene, 1,1,1–trichloroethane, and ortho– and para–dichlorobenzene.

In Phase IA of the Remedial Investigation, provision was made to collect a surface water sample from the head of Turtle Pond in order to determine if contamination exists in this permanent standing water body. Chemical analysis of the surface water sample indicated the presence of the dry cleaning solvent tetrachloroethene at a concentration of 16.5 ug/l and its breakdown product, trans–1,2–dichloroethene, at an estimated value of 2.3 ug/l. The established guidance value for Class AA–S surface waters (which is the classification assigned by NYSDEC to Turtle Pond) is 0.7 ug/l for tetrachloroethene. The guidance value for Class AA-S surface waters for trans-1,2-dichloroethene is 50 ug/l. A comparison of the sample analytical data to the established water quality guidelines indicates that the concentration of tetrachloroethene in the surface water of Turtle Pond exceeds the guidance values.

It is possible that the contaminants found in Turtle Pond were transported to this location via stormwater runoff from the Mall that was channeled to the stream adjacent to Lake Avenue. Other scenarios may be that if ground water discharges to Turtle Pond, it is causing contamination in the surface water or that contaminated sediment in the Pond itself (as discussed in Section 6.4.3 below) is being resuspended, or the contamination may be a combination of the these routes of migration.

Surface water samples were also obtained from the Mianus River upgradient and downgradient of the study area, and the ponds downstream of Turtle Pond that discharge to the Mianus River. The analytes of concern were not detected in these surface water samples. It appears that significant surface water contamination within the study area is confined to the tetrachloroethene detected in Turtle Pond. Suggested mitigation of this contamination is discussed below.

6.4 Sediment Contamination

6.4.1 Summary of the General Occurrence of Hazardous Substances in Stormwater Drainage System Sediment

The 1983 Westchester County Department of Health investigation performed at the Hunting Ridge Mall collected a sediment sample from a catch basin adjacent to the Mall building and the dry cleaning establishment. The analytical results of this sample indicated the presence of high levels (greater than 100 mg/kg [parts per million – ppm]) of tetrachloroethene, trichloroethene and cis-1,2-dichloroethene. As a result, the owner of the Mall was directed by WCDH in 1985 to remove the sediment in the catch basin (and pipes) of the stormwater drainage system in order to mitigate migration of these chemicals off-site.

As part of this Remedial Investigation, sediment samples were collected from the stormwater drainage system during both Phase IA and IB to determine if residual contamination still exists in the sediments. The focus of the drainage system sampling was placed on the several catch basins located on the Mall property and along Route 22.

The catch basin located upgradient of the Hunting Ridge Mall and downgradient of the Perrenial Gardens (an establishment located adjacent/southwest of the Mall) was sampled. The analytical data indicated that no detectable concentrations of the analytes of concern existed in the sediment obtained from this catch basin.

The stormwater catch basin located directly adjacent to the dry cleaning establishment, which apparently received wastewater overflow from the Mall's leaching field, as well as product and waste spills/leaks that could have occurred in the vicinity of the basin, was also sampled. The analytes of concern detected in this sediment sample were tetrachloroethene (39 ug/kg), trichloroethene (17 ug/kg), trans-1,2-dichloroethene (51 ug/kg), 1,1,1-trichloroethane (6.0 ug/kg) and toluene (estimated concentration of 4.0 ug/kg). Also, 2-butanone was found at 16.0 ug/kg.

In addition, the sediment from this catch basin contained levels of selenium and silver at 7.4 mg/kg and 7.1 mg/kg, respectively. These concentrations exceeded the NJDEP guidelines for these metals in soil in evaluating cleanup requirements. The NJDEP guidelines for selenium and silver are 4 mg/kg and 5 mg/kg, respectively. Although none of these metals were found in ground water and surface water in the study area at concentrations that exceeded ARARs, the exceedence of the NJDEP soil guidelines suggests the need for further evaluation/investigation of this contamination.

The catch basin located approximately 100 feet northeast and downgradient of the catch basin adjacent to the dry cleaner was sampled. The analytes of concern were not detected in this sediment sample.

The catch basin along Route 22 located between the Shorco Gas Station and the Village Inn Restaurant was also sampled. A concentration of 5.0 ug/kg tetrachloroethene was detected in the sediment sample obtained from the catch basin.

The last catch basin in the stormwater drainage system before it discharges to the stream along Lake Avenue was sampled. The analytical results also indicated the presence of 5.0 ug/kg tetrachloroethene in the sediment sample.

A review of the catch basin sediment data indicates that low levels (less than 100 ug/kg [parts per billion – ppb]) of organic chemical contamination still exist in portions of the stormwater drainage system/catch basins that service the study area. The most substantial contamination occurs in the sediment of the catch basin adjacent to the dry cleaning establishment. Total volatile organic chemicals in the sample obtained from this basin equal 133 ug/kg.

As discussed early in this section, soil/sediment standards or guidance values do not exist in New York State for organic chemical contamination. As a means of comparison for determining the significance of the levels of contamination found in the sediment during this investigation, the New Jersey Department of Environmental Protection (NJDEP) has established a guidance value of 1 part per million (ppm) or 1,000 ppb for total volatile organic chemicals in soil (sediment) in evaluating cleanup requirements. Based on the sample results and this ARAR, it appears that the previous remedial action was essentially successful in removing significantly contaminated sediment from the stormwater drainage system.

6.4.2 Summary of the General Occurrence of Hazardous Substances in Stream Sediment Adjacent to Lake Avenue

In 1985, as part of the removal of contaminated material from the stormwater drainage system, sediment was also removed from the ephemeral stream bed along Lake Avenue. The sediment removed was sampled and the analytical results indicated elevated concentrations of volatile organic chemicals (tetrachloroethene [600 ug/kg], trichloroethene [56 ug/kg], cis–1,2–dichloroethene [25 ug/kg] and methylene chloride [50 ug/kg]). This sediment was transported off–site for disposal.

As part of the Phase I sampling program of this Remedial Investigation, provisions were made to collect samples from the stream bed adjacent to Lake Avenue to determine if residual contamination exists in the sediment.

During the Phase IA program, a sediment sample was collected at the discharge point of the subsurface stormwater drainage system to the head of the stream bed. The analytical results of this sample indicated the presence of 1,1,1–trichloroethane at 9 ug/kg and 2–butanone at 14 ug/kg.

As a result of this finding, expanded sediment sampling of the stream bed was undertaken as part of Phase IB of the investigation. In this phase, six sediment samples were collected from three locations along the stream bed. At each location, one sample was obtained from a depth of 6 inches below the surface of the stream bed and a second sample obtained from a depth of 24 inches.

The first sample location in the stream bed was located eight feet downgradient of the stormwater discharge pipe. Chemical analysis of the two sediment samples indicated the presence 2-butanone at an estimated concentration of 5.8 ug/kg at a depth of 6 inches and an estimated concentration of 3.0 ug/kg at a depth of 24 inches.

The second sample location in the stream bed was located just north of the Mullaney residence driveway, approximately 100 feet downgradient of the drainage pipe. The chemical analysis of both the samples obtained at 6 inches and 24 inches in depth did not detect any of the analytes of concern.

The third and final sampling location in the stream bed was located just south of the Mullaney residence driveway approximately 150 feet downstream of the discharge pipe. The sediment sample collected from the depth of 6 inches contained benzene at an estimated concentration of 1.0 ug/kg and chlorobenzene at a concentration of 8.0 ug/kg. The sediment sample obtained from the depth of 24 inches did not detect any of the analytes of concern.

A review of the analytical data of the sediment samples collected indicates that low levels of volatile organic chemical contamination exists in the sediment of the stream bed along Lake Avenue.

Based upon this analytical data, it appears that the 1985 sediment removal was successful in removing the dry cleaning related organic chemical contamination from the ephemeral stream bed, however, other contaminants exist intermittently in low/less than significant levels (as compared to the NJDEP soil cleanup guidance values) in the stream bed.

6.4.3 Summary of the General Occurrence of Hazardous Substances in Pond Sediments

In the Phase IA sampling program, a sediment sample was obtained from Turtle Pond which is the first pond in a series of three ponds before stormwater drainage/surface water discharges from the study area to the Mianus River.

Chemical analysis of the sediment indicates the presence of tetrachloroethene at 44 ug/kg, as well as 1,1,1-trichloroethane at 16 ug/kg and 2-butanone at 79 ug/kg.

As a result of this finding, as part of the Phase IB program, the sediment in Turtle Pond was resampled and sediment in the two additional ponds downstream of Turtle Pond was also sampled.

In Phase IB, the sediment sample collected from Turtle Pond was obtained at the head of the pond similar to the first sample in Phase IA, but taken at a depth of 9 inches rather than at the sediment surface.

The analytical results of this sample indicated the presence of tetrachloroethene at a concentration of 600 ug/kg and its breakdown compounds, trichloroethene at 240 ug/kg and trans-1,2-dichloroethene at 31 ug/kg. A concentration of 2-butanone of 34 ug/kg was also detected in this sample.

In the second pond, which is downgradient of Turtle Pond, a sediment sample was obtained at the head of the pond at a depth of 6 inches below sediment surface. The chemical analysis of this sample indicated the presence of 2-butanone at a concentration of 20 ug/kg.

A sediment sample was collected at the head of the third, downgradient pond, at a depth of 12 inches, had an estimated concentration of 2-butanone at 18 ug/kg.

A review of the chemical analytical data generated from the pond sediment sampling indicates that a significant concentration of tetrachloroethene and its degradation products exists in the sediment of Turtle Pond. The concentration of organic chemical contamination is the highest concentration found in the study area as part of this investigation. The concentration of total volatile organic chemicals (905 ug/kg [ppb]) is close to the NJDEP guideline of 1,000 ppb used in evaluating the need for cleanup/removal of these sediments.

In the other sediment samples obtained from the ponds downstream of Turtle Pond, only low concentrations of 2-butanone were detected. 2-Butanone is a common solvent used in paints and appears to be wide spread in low levels throughout most of the surface water/drainage system in the study area and low (less than significant) residual concentrations remain in the surface water sediments.

6.4.4 Summary of the General Occurrence of Hazardous Substances in Mianus River Sediments

As part of the Phase I sampling program, two sediment samples were collected from the Mianus River. These samples were obtained at the same locations as the surface water samples discussed in Section 6.3.1, above.

One of the two samples was collected from the Mianus River at a point upstream of from the study area. The purpose of sampling at this location was to document Mianus River sediment quality that has not been impacted by contaminant discharges in the study area. This upgradient sample also serves as a control in identifying Mianus River sediment quality that is entering and may be impacting the study area. The chemical analysis of the upgradient sediment sample detected 2-butanone at a concentration of 39 ug/kg.

The second sediment sample of the Mianus River was obtained at the confluence of the stream/pond system discharge to the river. The purpose of this sample was to identify drainage system sediment contamination that has migrated through the study area and has entered the river. The analytical data for this sediment sample detected 1,1,1-trichloroethane at a concentration of 10 ug/kg and a concentration of 2-butanone at 188 ug/kg. Compared to the ARARs established for soil/sediment in this investigation, these levels are not significant.

A review of the analytical results generated by the Mianus River sediment sampling illustrates the ubiquitous occurrence of 2-butanone in the Mianus River, as well as those in the other surface waters sediments in the study area. While it appears that the Hunting Ridge Mall Study Area may be contributing to the low levels of 2-butanone contamination found in the Mianus River sediment, it also appears that another unidentified source(s) of 2-butanone contamination exists upgradient of the study area.

It also appears that sediment containing low concentrations of 1,1,1-trichloroethane may have migrated through the study area and discharged to the Mianus River.

6.5 Subsurface Soil Contamination

As part of in-field screening (with an organic vapor analyzer), split spoon soil samples were collected from varying depths during construction of the monitoring wells in the study area and selected samples were sent to a field laboratory for volatile organic chemical analysis.

Sample screening provided timely soil chemical data which was used in determining zones of contamination in the borehole, in assessing if contamination migration is stratigraphically controlled, and in selecting the placement of the well screen in the borehole in order to obtain optimum ground water contamination data.

Split spoon soil samples were collected for soil screening from borings MW-5M, MW-6M, MW-12M and MW-13M. All four borings are located on the Ponds Development Property which is downgradient of the Hunting Ridge Mall and in, or contiguous to, the ground water contaminant plume.

Based on the soil screening analytical data, volatile organic contamination was not detected in the soils submitted from the MW-5M borehole location.

At the MW-6M location, which is located approximately 550 feet to the northeast of MW-5M, the soil screening data detected concentrations of trichloroethene at the following depths, 10 to 12 feet (1,560 ug/kg), 25 to 27 feet (62 ug/kg) and 30 to 32 feet (15 ug/kg). The trichloroethene concentration detected at the 10 to 12 foot depth in the unsaturated zone appears to be an anomaly. A concentration of 1,560 ug/kg is significant and it would be expected that some contamination would be detected in the soil sample obtained from the 5 to 7 foot depth above and the 15 to 17 foot depth below. A review of the data indicates trichloroethene was not detected in the overlying or underlying samples.

The two remaining soil samples in which trichloroethene was detected (25 to 27 feet [62 ug/kg] and 30 to 32 feet [15 ug/kg]), are located at the top of the saturated zone in the MW-6M borehole. The concentrations detected in these two samples are of a value that are more characteristic of the expected chemical concentrations in the study area and are considered relevant.

The one sample submitted from the MW-12M location (which is located between MW-5M and MW-6M) detected trichloroethene at a concentration of 4.9 ug/kg and toluene at 1.6 ug/kg. This soil sample was collected at a depth of 30 to 32 feet which is at the top of the saturated zone in the MW-12M borehole.

Nineteen soil samples were submitted for volatile organic chemical screening from the MW-13M location. All soil samples obtained from the MW-13M borehole indicated the presence of trichloroethene. The concentrations of trichloroethene ranged from 6.2 ug/kg to 35.5 ug/kg. The 35.5 ug/kg concentration was detected in the soil sample obtained from a depth of 50 to 52 feet below ground surface in the saturated area.

The results of the soil samples obtained from the boreholes are consistent with the findings of ground water samples obtained from wells constructed in these locations as described below in Section 6.4.2. No ground water contamination was found at location MW-5, fairly significant contaminant levels were found at MW-6, and only trace amounts of contamination were detected at MW-12 and MW-13.

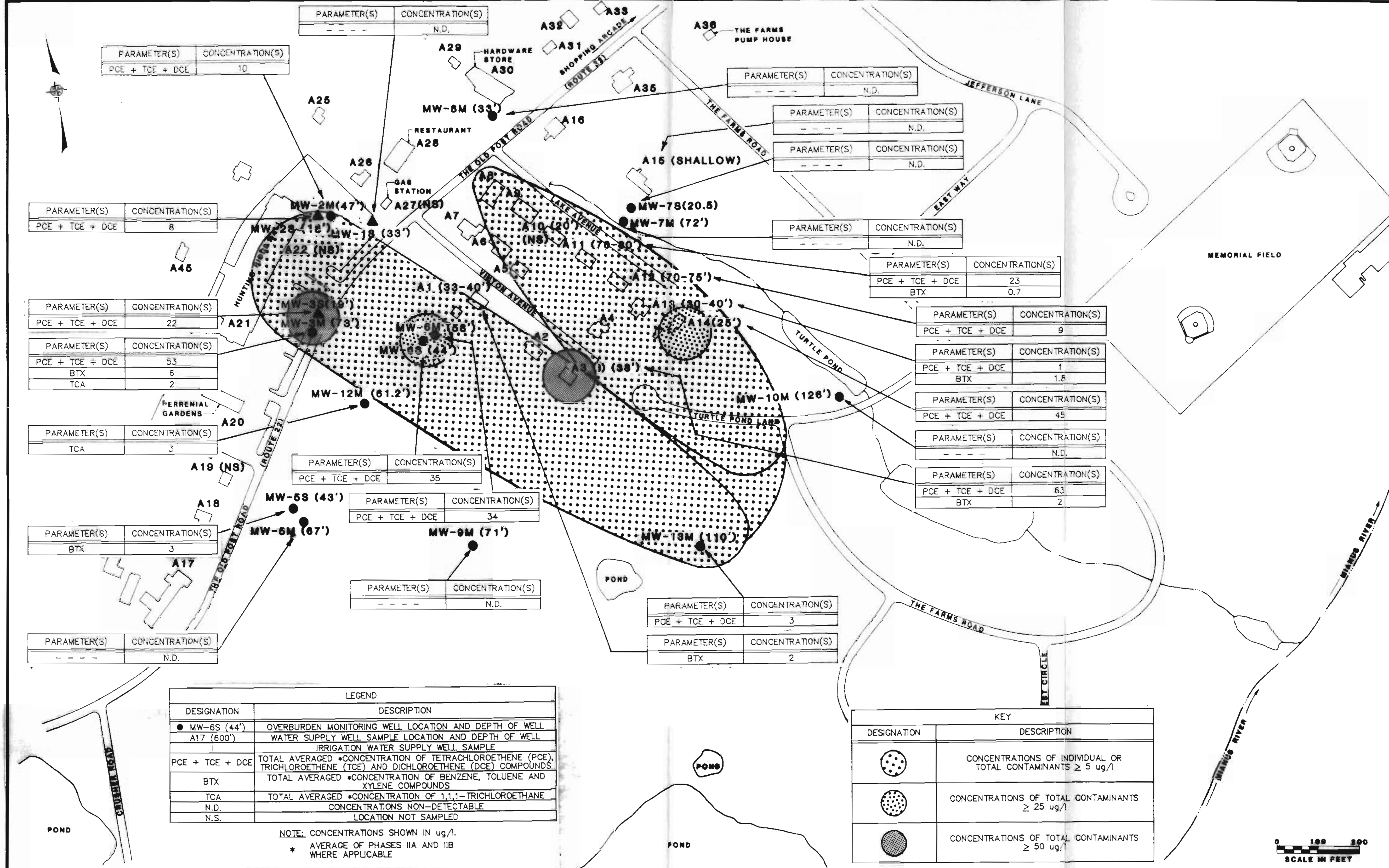
Except for the anomolus finding at MW-6 at 10 to 12 feet below ground surface, none of the subsurface soil samples yielded contaminant levels that approach the NJDEP guidelines for cleanup.

6.6 Ground Water Contamination

6.6.1 General Occurrence of the Dry Cleaning Solvent (Tetrachloroethene) and its Breakdown Compounds in Ground Water Within the Unconsolidated Stratified Drift Deposits

A review of the data generated from ground water samples obtained from wells (monitoring and private water supply) which draw from the shallow unconsolidated stratified drift deposits begins to define the nature and extent of ground water contamination in the study area. (Refer to Figure No. 6-1.)

The present definition of the primary plume comprising the dry cleaning solvent tetrachloroethane and its breakdown products appears to be about 300 feet in width and extends 1,200 feet from the Hunting Ridge Mall property to the southeast as far as monitoring well location MW-13 and possibly beyond. The general trend of subsurface contaminant migration is in the direction of ground water flow to the southeast of the Hunting Ridge Mall.



LEGEND

DESIGNATION	DESCRIPTION
● MW-6S (44')	OVERBURDEN MONITORING WELL LOCATION AND DEPTH OF WELL
A17 (600')	WATER SUPPLY WELL SAMPLE LOCATION AND DEPTH OF WELL
I	IRRIGATION WATER SUPPLY WELL SAMPLE
PCE + TCE + DCE	TOTAL AVERAGED *CONCENTRATION OF TETRACHLOROETHENE (PCE), TRICHLOROETHENE (TCE) AND DICHLOROETHENE (DCE) COMPOUNDS
BTX	TOTAL AVERAGED *CONCENTRATION OF BENZENE, TOLUENE AND XYLENE COMPOUNDS
TCA	TOTAL AVERAGED *CONCENTRATION OF 1,1,1-TRICHLOROETHANE
N.D.	CONCENTRATIONS NON-DETECTABLE
N.S.	LOCATION NOT SAMPLED

NOTE: CONCENTRATIONS SHOWN IN ug/l.
* AVERAGE OF PHASES IIA AND IIB WHERE APPLICABLE

KEY

DESIGNATION	DESCRIPTION
(sparse dots)	CONCENTRATIONS OF INDIVIDUAL OR TOTAL CONTAMINANTS ≥ 5 ug/l
(dense dots)	CONCENTRATIONS OF TOTAL CONTAMINANTS ≥ 25 ug/l
(shaded)	CONCENTRATIONS OF TOTAL CONTAMINANTS ≥ 50 ug/l

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BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
WESTCHESTER COUNTY, NEW YORK
HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
TOTAL ORGANIC CONTAMINATION
IN OVERBURDEN WELLS

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FIGURE NO. 6-1

Although the furthestmost extent of contaminant migration has not been absolutely determined, it appears, based on the low contamination levels at the identified "near perimeter" monitoring wells, that the plume is most likely close to that shown in Figure No. 6-1. The furthest monitoring point in the southern portion of the study area (MW-9M) did not contain contamination. The furthest downgradient monitoring point in the southeastern portion of the study area (MW-13M) contains an estimated concentration of 3.0 ug/l of tetrachloroethene (refer to Figure No. 4-10). As part of the water supply sampling program, four residential monitoring well locations were sampled on the eastern side of the river. No contamination was detected in these samples. This infers that it appears the contaminant plume is confined to the west of the Mianus River and has not migrated as far as the river or that the Mianus River may act as a ground water boundary/divide.

The northern most limit of the primary/dry cleaning solvent plume appears to be in the vicinity of Vinton Avenue where it commingles with a secondary ground water contaminant plume most likely created by the recharge of contaminated stormwater runoff previously originating from the Hunting Ridge Mall drainage system through the stream bed along Lake Avenue. As illustrated in Figure No. 6-1, based upon available data, it appears that this secondary contaminant plume extends south to Lake Avenue where it commingles with the primary plume, southeast to about the location of MW-13 (or possibly beyond), and north to perhaps slightly beyond or directly beneath the stream bed. Pumping of private wells along Lake and Vinton Avenues probably draws most of the contaminated ground water to the south. Recharge of water through the stream bed along Lake Avenue and Turtle Pond most likely also results in diverting contaminated ground water to the south.

In order to determine areas of significant ground water contamination, which may pose a potential hazard to human health and the environment, it is necessary to compare the detected concentrations of tetrachloroethene, its degredation products and other selected contaminants to established standards and guidance values established for ambient ground water.

Review of the analytical chemical data obtained during this Remedial Investigation indicates that tetrachloroethene was detected at a concentration exceeding the established TOGS guidance value of 0.7 ug/l for ambient ground water throughout most of the study area, in the vicinity of and downgradient of the Hunting Ridge Mall Site.

In terms of potential public health impact on those consuming the ground water, standards have been adopted by the New York State Department of Health (NYSDOH) in January 1989 which establishes Maximum Contaminant Limits (MCLs) for organic chemicals in public/community drinking water supplies. These standards, although they do not pertain directly to private (individual well) water supplies, are relevant to the Hunting Ridge Mall Study Area because the water obtained from these wells is used for potable purposes. The MCL established for tetrachloroethene in public drinking water supplies is 5.0 ug/l. In addition, the breakdown compounds of tetrachloroethene, which include trichloroethene and cis/trans-1,2-dichloroethene, and were detected in the study area, also have established limits of 5.0 ug/l in drinking water. Figure No. 6-1 illustrates the occurrence of these parameters as well as other contaminants of concern in private wells which exceed the established NYSDOH drinking water supply standards. It should be noted that water supply sampling locations A4 [5.0 ug/l of trans-1,2-dichloroethene] and A12 [8.0 ug/l of trans-1,2-dichloroethene] are two additional sampling locations with elevations above the standards which are outside of the immediate study area (refer to Figure No. 5-2). More detailed discussion of the results of water supply sampling and comparison to standards and guidance values is provided in Section 5.4, above.

Generally the highest concentrations of tetrachloroethene are located on the Hunting Ridge Mall property (33 to 59 ug/l) and extend in a east-southeast direction from MW-3, to MW-6, to the southern end of Vinton Avenue (water supply sampling locations A2 and A3 [22 to 58 ug/l]) and Lake Avenue (water supply sampling location A14 [45 ug/l]) (refer to Figure Nos. 4-8 and 4-10 and Figure No. 5-2).

Although the highest concentrations of tetrachloroethene were generally found on the Hunting Ridge Mall property, Table No. 6-5 shows that based on historical analytical results of on-site wells MW-1S, MW-2S and MW-3S (installed by the Mall owner), levels of tetrachloroethene and its breakdown compounds have decreased, at least in the shallow wells, since their initial sampling conducted by the Mall owner in January, 1985. This occurrence most likely reflects the cessation of discharges of dry cleaning solvent from the dry cleaning establishment on the Mall property.

A zone of slightly lower concentration (10 to 17 ug/l) of tetrachloroethene is located between Vinton and Lake Avenues and was detected at tap water sampling locations A5 (11 ug/l), A8 (17 ug/l) and A11 (10 ug/l) (refer to Figure No. 5-2).

Table No. 6-5

HISTORICAL ANALYTICAL RESULTS OF
MW-1S, MW-2S AND MW-3S

Well Designation	Date Sampled	Parameters (ug/l) Tetrachloroethene	Trichloroethene	1,2-Dichloroethene
MW-1S	Jan. 1985*	ND	3	2
	Aug. 1986*	5	ND	12
	Oct. 1988	ND	ND	ND
	Feb. 1989	ND	ND	ND
MS-2S	Jan. 1985*	80	24	30
	Aug. 1986*	9	ND	6
	Jan. 1988	ND	8.6	ND
	Oct. 1988	ND	ND	ND
MS-3S	Jan. 1985*	141	5	2
	Aug. 1986*	15	ND	ND
	Jan. 1988	33	ND	ND
	Oct. 1988	10	ND	ND

*Sampled by Mall owner

ND = Not Detected

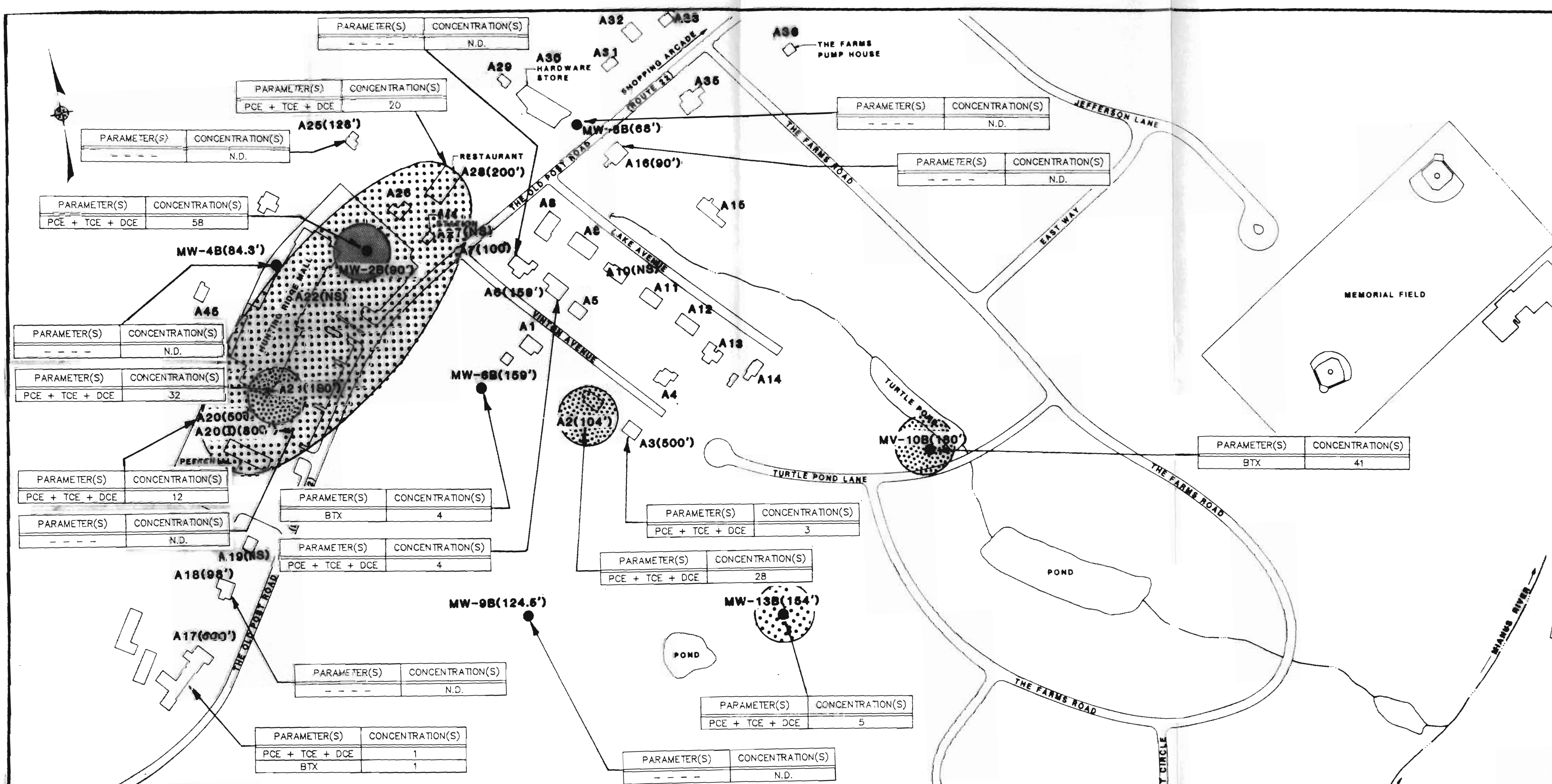
6.6.2 General Occurrence of the Dry Cleaning Solvent (Tetrachloroethene) and its Breakdown Compounds in Ground Water Within the Bedrock

Understanding ground water flow and contaminant migration in fractured bedrock is complex. The physical properties of the underlying bedrock such as its hardness, weathering, direction and degree of fracturing and the continuity of fracturing, as well as the hydraulic properties including the associated hydraulic pressures, recharge, discharge and the effect of pumping wells, all have an influence on ground water flow and contaminant migration.

Specific to the Hunting Ridge Mall Study Area, initially it is important to note that ground water contamination exists in the bedrock underlying the Mall property and contiguous areas (see Figure No. 6-2). The highest concentration of contamination found in bedrock was at the MW-2B boring location (57 ppb of tetrachloroethene and 15 ppb of 1,2-dichloroethene) (refer to Figure No. 4-10).

Decreasing concentrations of tetrachloroethene were detected in proximity of MW-2 and along the ridge line which outcrops adjacent to the Hunting Ridge Mall. To the northeast, at water supply sampling location A28 (Village Inn restaurant), 15 ug/l of tetrachloroethene and 5.0 ug/l of 1,2-dichloroethene was detected in a 200 foot deep bedrock well. Trending to the southwest along the ridge line, the Hunting Ridge Mall water supply production well (a 180 foot deep well, located approximately 450 feet southwest of MW-2) contained 27 ug/l of tetrachloroethene and 5.0 ug/l of 1,2-dichloroethene. Continuing to the southwest, water supply sampling location A20 (Perrenial Gardens, located approximately 500 feet from MW-2) contained 12 ug/l of tetrachloroethene in a estimated 500 foot deep production well (refer to Figure No. 5-2). At the above mentioned locations, the detected concentrations of tetrachloroethene exceed both the NYSDEC ambient ground water guidance values and the established NYSDOH public drinking water supply standards.

To the southeast, in the direction of ground water flow, tetrachloroethene was detected in the MW-13 boring location at 5.0 ug/l as well as in the southern portion of Vinton Avenue at water supply sampling location A3 (estimated 3.0 ug/l of tetrachloroethene in a 500 foot deep residential well) and at A4 (estimated 2.0 ug/l of tetrachloroethene and 5.0 ug/l 1,2-dichloroethene in an estimated 175 foot residential well) (refer to Figure No. 4-10 and Figure No. 5-2). The MW-13 boring location and water supply sampling locations, A3 and A4, exceed the ambient ground water guidance concentrations for tetrachloroethene. The MW-13 boring location and water supply sample location A4 equal the public drinking water supply standard.



LEGEND

DESIGNATION	DESCRIPTION
● MW-10B (180')	BEDROCK MONITORING WELL LOCATION AND DEPTH OF WELL
A17 (600')	WATER SUPPLY WELL SAMPLE LOCATION AND DEPTH OF WELL
I	IRRIGATION WATER SUPPLY WELL SAMPLE
PCE + TCE + DCE	TOTAL AVERAGED *CONCENTRATION OF TETRACHLOROETHENE (PCE), TRICHLOROETHENE (TCE) AND DICHLOROETHENE (DCE) COMPOUNDS
BTX	TOTAL AVERAGED *CONCENTRATION OF BENZENE, TOLUENE AND XYLENE COMPOUNDS
TCA	TOTAL AVERAGED *CONCENTRATION OF 1,1,1-TRICHLOROETHANE
N.D.	CONCENTRATIONS NON-DETECTABLE
N.S.	LOCATION NOT SAMPLED

NOTE: CONCENTRATIONS SHOWN IN ug/l.
* AVERAGE OF PHASES IIA AND IIB WHERE APPLICABLE

KEY

DESIGNATION	DESCRIPTION
	CONCENTRATIONS OF INDIVIDUAL OR TOTAL CONTAMINANTS $\geq$ 5 ug/l
	CONCENTRATIONS OF TOTAL CONTAMINANTS $\geq$ 25 ug/l
	CONCENTRATIONS OF TOTAL CONTAMINANTS $\geq$ 50 ug/l

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BEDFORD VILLAGE WELLS
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
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HUNTING RIDGE MALL SITE

HUNTING RIDGE MALL STUDY AREA
TOTAL ORGANIC CONTAMINATION
IN BEDROCK WELLS

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FIGURE NO. 6-2

It is difficult to determine how resistant the bedrock zone is to the infiltration of contamination from the overburden zone. As described above, commercial bedrock production wells located in proximity of the Hunting Ridge Mall (and the MW-2 boring location) contain the highest concentrations of tetrachloroethene (and its breakdown compounds) in the study area. Low levels of tetrachloroethene and its degradation products are also associated with residential bedrock water supply wells on the south side of Vinton Avenue (water supply sampling locations A3 and A4).

These wells are located in the center of contaminated ground water in the study area. However, monitoring well MW-6B, which is also located in the area of overburden ground water contamination, does not exhibit tetrachloroethene contamination. It appears that the contamination in the overburden can exist at certain locations without impacting the immediately underlying bedrock. Conversely, other (production and monitoring) wells in the bedrock zone in the area of overburden ground water contamination are impacted by the overlying contamination. Based on the distribution of bedrock contamination and the downward vertical gradients observed in the well clusters installed in the study area, it appears that the pumping of ground water from bedrock in areas that contain ground water contamination in the overlying overburden promotes contaminant migration to the underlying bedrock.

This pumping influence is evidenced by the fairly significant recharge (vertical component of ground water flow as determined by the measurement of water levels in well clusters [see Section 4.7.2]) at the MW-2 location on the Mall property. Elsewhere in the study area where there is little influence of pumping, only slight natural recharge of ground water from the shallow overburden to the deeper overburden/ bedrock zones exists.

6.6.3 General Occurrence of Other Compounds in Ground Water in the Study Area

A review of the ground water sampling results from monitoring wells and private water supply wells indicates that there exists four general types of chemical contamination at the Hunting Ridge Mall Study Area.

The type of chemical contamination that is most significant in the study area, and discussed most widely in this report, is the dry cleaning solvent tetrachloroethene and its breakdown products, trichloroethene and trans-1,2-dichloroethene.

A second type of chemical contamination detected as a specific group in the ground water are low levels of benzene, toluene and xylene (BTX). BTX compounds are are used as solvents and thinners and associated with paints, lacquers and dyes. Another major source of these compounds is gasoline. In gasoline, BTX compounds are utilized as additives to increase the octane level. The NYSDEC ambient ground water standard for benzene is non–detectable. Toluene and xylene both have established guidance values of 50 ug/l. The established public drinking water supply standard for benzene, toluene and xylene is 5.0 ug/l.

The third group of chemical containments detected in ground water in the study area is 2–butanone (methyl ethyl ketone) and chlorobenzene. 2–Butanone is a common paint solvent and chlorobenzene is an insecticide. The ambient ground water guidance value for chlorobenzene is 20 ug/l. No ambient ground water value has been established at present for 2–butanone, however, the public drinking water supply standard established by NYSDOH for 2–butanone is 50 ug/l. The ground water guidance value for chlorobenzene is 20 ug/l and the drinking water standard is 5.0 ug/l.

The final group/single contaminant is 1,1,1–trichloroethane, which is a common cleaning solution/degreaser and is often used in sanitary septic tanks and leaching systems.

6.6.3.1 General Occurrence of Benzene, Toluene and Xylene in Ground Water

Low levels of BTX contamination were detected in several of the ground water samples collected from the unconsolidated overburden deposits and the underlying bedrock strata in the study area. Concentrations of these compounds ranged from an estimated 0.7 ug/l to 41 ug/l.

In the residential wells sampled as part of the water supply sampling program, 11 wells detected at least one of the BTX compounds, 4 of which (water supply sampling locations A2, A11, A26 and A35) exceed the NYSDEC TOGS, and 1 of which (location A2) is at the standard for drinking water (5.0 ug/l of toluene).

The BTX contamination detected in residential wells were in the vicinity of and downgradient of the Shorco Gas Station. Based on information provided as part of this investigation, it has been reported that in the past, one of the Shorco Gas Station tanks was found leaking and was replaced. It appears that residual BTX contamination exists in this area and may be associated with this former leak.

In addition to water supply wells, ground water samples obtained from two monitoring wells detected the presence of benzene and toluene. Monitoring well MW-6B which is located in the general vicinity and downgradient of the Shorco Gas Station detected an estimated concentration of 3.8 ug/l of toluene in the bedrock zone. The highest concentration of BTX compounds detected in the study area was in the bedrock well at the MW-10B boring location adjacent to Turtle Pond and also downgradient of the gas station (39.0 ug/l of toluene and an estimated 2.0 ug/l of benzene).

6.6.3.2 General Occurrence of 2-Butanone and Chlorobenzene in Ground Water

Low concentrations of 2-butanone and chlorobenzene were detected in several of the residential wells sampled as part of the water supply sampling program. A review of the ground water analytical data indicates that there exists low concentrations of 2-butanone in ground water on the north side of Route 22 just northeast of the Hunting Ridge Mall. The concentrations of 2-butanone in ground water ranged from an estimated 0.6 ug/l to an estimated 1.0 ug/l. The highest concentration of 2-butanone (estimated 1.0 ug/l) was detected at the A25 water supply sampling location which is located behind the Village Inn Restaurant. None of these values exceed the standard for this compound.

A low concentration of chlorobenzene exists in the ground water in the vicinity of the stream along Lake Avenue. The concentrations of chlorobenzene detected ranged from an estimated 0.5 ug/l to an estimated 2.0 ug/l at water supply sampling locations A4, A13 and A15. The highest concentration of this compound was detected at the A4 sampling location at an estimated value of 2.0 ug/l. This sampling point is located at the southern end of Vinton Avenue. A review of the ground water data indicates that all the concentrations of 2-butanone and chlorobenzene detected at the study are are below the established ground water and drinking water supply limits.

6.6.3.3 General Occurrence of 1,1,1-Trichloroethane in Ground Water

1,1,1-Trichloroethane, which is a common degreasing agent and often used in sanitary leaching system cleaners, was found in only one ground water/water supply sample obtained in the study area. The location of this sample is A33 which is a private residence along Route 22 in the extreme northeastern portion of the study area. This compound was detected in both a shallow irrigation well at 5.0 ug/l and the deeper potable water supply well at 9.0 ug/l. These values are less than the NYSDEC ambient ground water guidelines of 50 ug/l, but equal to or greater than the NYSDOH public drinking water standard of 5.0 ug/l.

6.7 Comparison Between Source, Soil, Sediment and Ground Water Contamination

A review of the historical data complemented by the analytical chemical data generated as part of this Remedial Investigation has significantly increased the understanding of contaminant migration in the Hunting Ridge Mall Study Area.

As previously discussed, as part of the 1983 investigation conducted by the Westchester County Department of Health (WCDH), liquid samples were collected from the septic tank and dosing chamber, both of which are part of the subsurface disposal system serving the Hunting Ridge Mall. The chemical analyses of these samples indicated the presence of high concentrations of trichloroethene and cis-1,2-dichloroethene.

At the time, the WCHD was informed that the septic tank was pumped out on a regular basis. It was concluded by WCHD that the volatile organic compounds (VOCs) detected in the septic tank and dosing chamber were most likely residual material not removed during such pumping.

In August 1985, the Mall owner, in cooperation with the WCHD, conducted a soil sampling and analysis program to characterize the uppermost soils behind the Mall building in the area of both the old and existing effluent leaching system. Thirteen soil samples were collected from depths of two feet below the location of the former leaching pools in the old septic system and two feet below the bottom of the leaching pools in the existing system. Chemical analysis did not detect the analytes of concern in any of the soil samples.

Based on these results it seems somewhat inconsistent that in the fall of 1983, WCHD detected high concentrations of VOCs in the septic system, while in the summer of 1985, no contamination could be detected in the soils associated with the leaching system.

A few of the scenarios that could be used in explaining the above findings are:

- The Mall's septic tanks were pumped out on a regular basis after 1983 because of failure of the leaching system, and little, if any, of the VOC contamination was discharged to the leaching field.

- The concentrations of VOCs discharged to the leaching field were either flushed out or volatilized in the almost two year time lapse between samplings.

- o The effluent from the leaching pools discharged essentially directly on top of the underlying bedrock (reported to be only about six feet below ground surface and less than two feet below the leaching pools), and recharged either directly to bedrock or flowed over the bedrock surface and recharged elsewhere, or at least in part, discharged to the parking area behind the Mall building and into the stormwater drainage system leaving no residual contamination in the overlying soils. (It seems that this situation [or perphaps a combination of all three scenarios] is the most plausible circumstance.) It should be noted, that the failure of the leaching system causing the runoff of wastewater into the stormwater catch basin behind the Mall building in the vicinity of the dry cleaner was observed during the Remedial Investigation.

A review of the chemical analysis of the stormwater drainage system sediments indicates a significant pattern.

In 1983, the WCHD collected a sediment sample from the Hunting Ridge Mall stormwater drainage system. Chemical analysis of the sediment sample detected 88,000 ug/kg of tetrachloroethene, 32,000 ug/kg of trichloroethene and 19,000 ug/kg of cis-1,2-dichloroethene. As a result, the owner of the Hunting Ridge Mall was directed to clean out the catch basins and pipes of the Hunting Ridge Mall stormwater drainage system to mitigate migration of these chemicals off-site.

In March 1985, the stream bed along Lake Avenue that receives runoff from the Mall's stormwater drainage system was dredged and samples of the sediment were analyzed. The analytical data detected tetrachloroethene at 600 ug/kg, trichloroethene at 56 ug/kg, and cis-1,2,-dichloroethene at 25 ug/kg. The contaminated sediments were removed for off-site disposal.

In May of 1988, as part of this investigation, samples were obtained from the Mall's sanitary system supernatant, stormwater drainage system sediment in and downgradient of the Mall, stream bed sediment to which the drainage system discharges, Turtle Pond sediment and sediment from the two ponds in series downgradient of Turtle Pond.

Low levels of the analytes of concern were detected in the sanitary system supernatant, stormwater drainage system sediment and the stream bed along Lake Avenue, which indicates that remediation performed between 1983 and 1985 was effective and only low levels of residual contamination remain.

However, in the sediment sample obtained at the head of Turtle Pond which is just downgradient of the ephemeral stream discharge where contaminated soils were removed in 1985, 600 ug/kg of tetrachloroethene was detected. Trichloroethene (240 ug/kg) and 1,2–dichloroethene (31 ug/kg) were also detected in this sediment sample.

Although it is still uncertain to what degree the sanitary system and stormwater drainage system in the Hunting Ridge Mall contributed to ground water contamination in the study area, the analytical data suggests that the stormwater drainage system was a major pathway for contaminant migration.

A review of the construction drawings of the stormwater drainage system indicates that the type of pipe utilized in the system was of slotted design. This allowed for stormwater and associated sediment to discharge through the pipe at essentially any point in the system. This in turn allowed the contaminants present in the stormwater drainage system to recharge ground water at any point along the system. Not only could contaminant release occur throughout the full length of the subsurface drainage system, but it is evident from the 1985 stream sediment removal that some of the contaminants originating in the Hunting Ridge Mall were transported through the stormwater drainage system piping and were deposited in the stream bed (a form of contaminant sink). This release to the stream most likely also recharged through the bed and affected the quality of the ground water system. Note that the water level contours developed from data from this study (see Section 4.7.2) indicated that, at least at certain times, the stream appears to recharge the ground water.

As indicated above, a substantial concentration of tetrachloroethene still exits in sediment (600.0 ug/kg) at the head water of Turtle Pond, as well as in the surface water of the pond (16.5 ug/l). It should be noted that one of the highest concentrations of tetrachloroethene detected in ground water (45 ug/l) was detected in a residential well upgradient of Turtle Pond. It should also be noted that the highly contaminated sediment in the pond is overlain by cleaner sediment which was apparently deposited after cessation of contaminant discharges to the stormwater drainage system and removal of contaminated sediment from the stream.

Although more sampling would be required to further define the extent of the contaminant concentrations in sediment in Turtle Pond, the present data suggests that tetrachloroethene in the sediment at the head of the pond may still be contributing to surface water contamination in the study area.

Ground water samples obtained from monitoring well MW-10, located adjacent to Turtle Pond, did not show the presence of tetrachlorethene and its breakdown compounds. Therefore, the contaminated sediment found in Turtle Pond does not appear to be effecting ground water quality.

6.8 Evaluation of Contaminant Migration in Ground Water

A review of Figure Nos. 6-1 and 6-2 reveals that three pockets of elevated contaminant concentrations have been identified within the ground water in the Hunting Ridge Mall Study Area. In bedrock at the MW-2 boring location, tetrachloroethene and its breakdown compounds were detected at a total averaged (average of Phase II A and IIB sampling results) concentration of 58 ug/l. At a second pocket of contamnation, in the unconsolidated stratified drift deposits at MW-3, tetrachloroethene and its degredation products were detected at the overburden/bedrock interface at a total averaged (average of Phase IIA and Phase IIB sampling results) concentration of 53 ug/l. Approximately 650 feet to the east-southeast of MW-3, a third pocket of contamination was detected in the unconsolidated stratified drift deposits at a combined concentration of 63 ug/l.

The initial route of entry into the subsurface of the pockets of contamination detected at the MW-2 and MW-3 location is difficult to ascertain. The origin of the contaminants is most likely from the wastewater discharged to the Mall's sanitary system or from product/waste spilled/discharged to the stormwater drainage system or a combination of the two. If the contaminants are migrating from a previous discharge to the sanitary system, then it is possible that the wastewater discharged to the leaching field recharged directly to bedrock where it still exists at the MW-2 location. The conflicting argument to this scenario is that no detectable concentrations of the dry cleaning compounds were found in the MW-4 bedrock boring which is located immediately adjacent to and downgradient of the sanitary system leaching field. However, as discussed previously, contaminant migration in fractured bedrock is complex and it is possible for contamination to be detected in one bedrock well and yet not in another adjacent to it.

With regard to contamination at MW-3 (and to a lesser extent contamination in the overburden at MW-2), it is likely that the significant quantities of dry cleaning solvent were discharged to the stormwater drainage system (either directly or as a result of overflow of the leaching system) which immediately recharged the overburden and ground water beneath the system.

The depression in the bedrock at the MW-3 location (see Figure No. 4-13) may be acting as a sink in which contaminant migration may be slightly retarded. The contaminants within the bedrock depression may be gradually diluted with time or possibly flushed out of the depression periodically during storm events that significantly recharge ground water, or the elevated pockets of contamination may just be residual of a concentrated dry cleaning product/waste spill/discharge event(s). Six hundred fifty feet downgradient of MW-3, a similar pocket of residual dry cleaning solvent exists in ground water. This could be residual contamination from a spill/discharge, or contaminated ground water, a "slug" that concentrated at the MW-3 bedrock depression before being flushed out and continued migrating through the river valley.

Whichever the scenario, three pockets of fairly high levels of ground water contamination have been detected within the Hunting Ridge Mall Study Area. These pockets are located in the overall plume of contaminated ground water in the study area and the contamination appears to be migrating in the direction of ground water flow to the southeast. Concentrations of tetrachloroethene within these pockets and the contaminant plume exceed the NYSDOH drinking water standard by more than a multiple of 10, and the NYSDEC ambient ground water guidance value for tetrachloroethene is exceeded by a factor of greater than 80. In addition, trans-1,2-dichloroethene also is equal or slightly exceeds the water supply standard of 5.0 ug/l, but is not greater than the ground water guideline of 50 ug/l.

In a review of the historical and present chemical analytical data obtained from both monitoring wells and private water supply wells, it appears that in general the ground water contamination concentrations in the Hunting Ridge Mall Study Area declined in the early 1980's, most likely due to the cessation of waste discharges, clean out of the Mall's sanitary system and replacement of the leaching field, and removal of contaminated sediment in the stormwater drainage system at the Mall and the receiving stream bed along Lake Avenue to which the drainage system discharged. However, since that time (1983), the analytical results indicate that, contamination in the ground water is relatively steady state and will be slowly, over time, decreasing in concentration due to dilution, adsorption, migration, biological decay, etc.

The significant pockets of contamination that presently exist in the area of the Hunting Ridge Mall Site, with time, will also migrate downgradient through the study area towards the Mianus River.

Although it is anticipated that with natural attenuation, ground water will improve in the long term, it is expected that levels of ground water contamination in the study area, in particular downgradient of the Mall in the Ponds Development Property and along Lake and Vinton Avenues, will remain above ambient ground water and drinking water guidance values and standards for sometime. In addition, because there is evidence of ground water contamination in bedrock as well as the overlying stratified glacial drift, and because there is no evidence of a hydrogeologic barrier to preclude vertical migration of contamination, it is anticipated that deep wells installed in bedrock, downgradient/contiguous to the currently impacted areas in the overburden, will also be potentially subject to contamination in the future.

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